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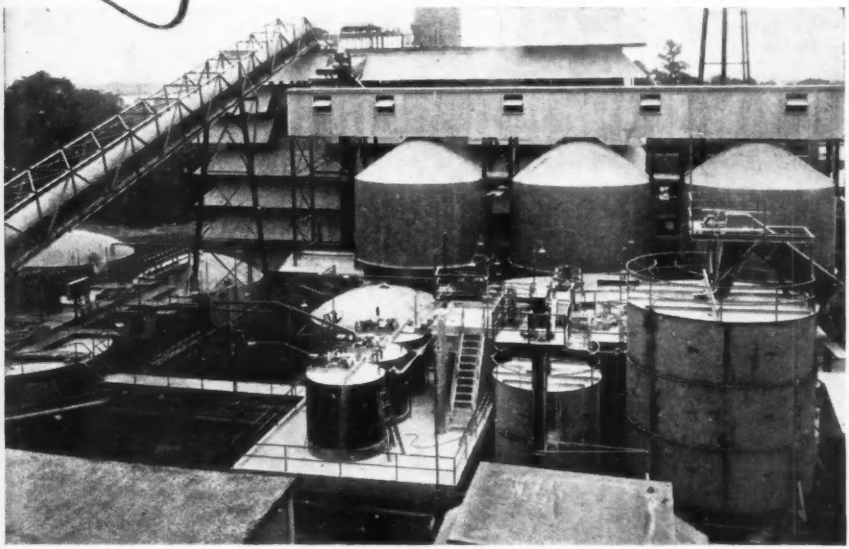

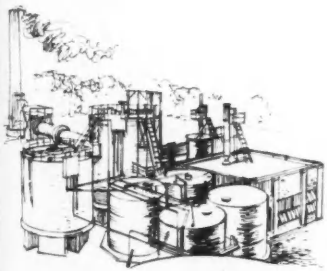

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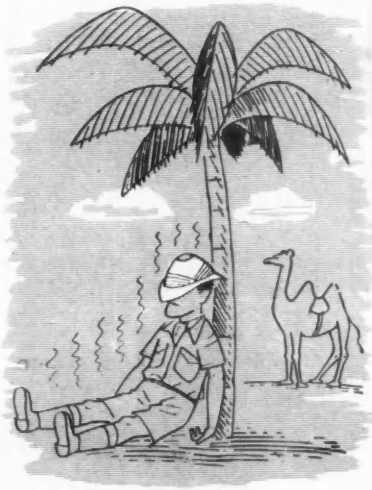

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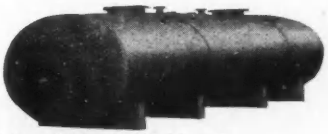

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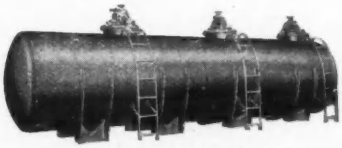

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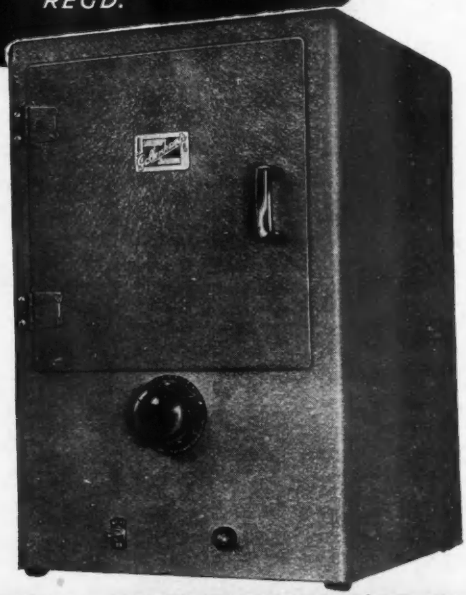

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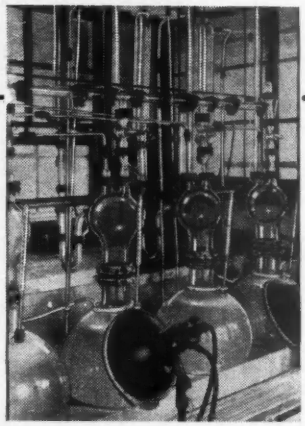

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Volume LXVI 14 June 1952 Number 1718

Scientific Man-Power

OUR comments last week were no more than a beginning to discussing the grave conclusions of the Advisory Council on Scientific Policy. So portentous a topic cannot be quickly dismissed. If Great Britain is to survive as a leading power in an increasing technological world, we need many more scientists; and it is clear that all our present arrangements for producing scientists cannot meet the situation even with rough approximation. Far too many of the best potential students leave school too soon. The public schools still underplace the sciences in their curricula and, worse still, in 'social' outlook. In any case, the good science teacher is becoming a *rara avis* of the Burnham world. These are difficult obstacles to dissolve. Not long ago there were persistent whisperings that the school-leaving age would be reduced as one of the new measures of national economy. If those morbid prophecies have not become a reality, we are at least forewarned by them that any proposals whereby more boys (and girls, of course) stay at school longer will encounter resistance. Can movements that are already settled be changed in tempo and direction so swiftly?

Similarly it has long been clear that for a few scientific subjects, and notably for chemistry, the graduate will elect to teach only to his severe economic disadvantage. A range of other jobs for which the same qualifications are needed will offer youthful starting salaries that are £100 or even £150 per year higher and they are jobs, too, whose prospects are unlimited. It is hardly enough to say that recruits for science teaching are not making up existing losses. Is it not also a fact that an appreciable number of mature science teachers are steadily leaving the service of education and entering industry? Yet to differentiate salary scaling according to subject—the obviously logical solution on supply-and-demand principles—would probably convulse the teaching profession in general and shatter the Burnham award system in particular. What can be done about it? Ultimately, the teaching of science—at any rate in boys' schools—will be left in the overworked hands of economic saints or industrial misfits, and to no subject will this apply more surely than chemistry.

Each of these problems bristles with wider complications and it is not cynical to fear that nothing that might be called drastic will be done about them until the threatened shortage of scientists is a more painfully evident reality. Chemical industry would be prudent to assume this. It is an assumption that for the next 10, 15, or even 20 years, companies requiring to take in a steady or rising number of scientists per year will be able to do

so with ever-lessening ease and selectivity. Organisations that succeed in maintaining a desirable standard and volume of intake will no doubt do so only at the expense of their competitors. The plight of the very small company, needing just one or two well-trained scientists in key-positions, may become most serious. Since it is one of the basic principles of management to make long-term arrangements for dealing with possible raw material shortages, it seems practical for industry to take an even more active part in the scientific education of its future staff. If it be true that much of the best human material leaves school too early, then it must equally be true that a hign proportion of this partially wasted ability enters the ranks of industry. Are the existing apprentice-schemes enough? Promising boys may be turned into skilled workers and even into key technicians but can industry afford to lose the minority? possibly 5 or 10 per cent, who would, had they stayed at school, have made good recruits for a science-graduate course at a university? Can more be done to spot real potentiality at the earliest stages of entrance to industry and can the risk of substantial investment in pre-education be taken? In the past our great industrial companies have not been slow or niggardly in directing financial help towards the universities, particularly towards those which have aimed at producing the well-equipped science graduate. The 'weak spot' now is not so much at the university level but at the school level. Such venturesome excursions as these into pre-education could only be risked by large organisations but they might well prove highly profitable in the outcome.

At the other end of the industrial scale, the very small firms may have to adjust their attitude towards scientist-employment. It cannot be denied that, say, 20 small companies create a demand for at least 20 chemists or chemical engineers when in truth the total technical task could be encompassed by a staff of four or five. With so much of our national industry centred in large cities, it is surprising that greater use has not been made of the advisory or consultant system. The need for secrecy on technical matters may have been an illusory obstacle but it is surely paradoxical that good accountants regularly play a consultant role for numbers of small companies but the similarly multiple use of good chemists is fairly exceptional. A great deal could be done in this direction and it would enable the country to make a much fuller use of its existing scientific man-power. Moreover, if it is not done, small companies will increasingly face not only the problem of recruitment to replace the loyal chemist who retires on age but the recurring problem of recruiting a new chemist to replace the man who is offered more scope and more salary by a bigger company. Unfortunately at a time when the nation would greatly benefit from a substantial expansion in the number of consultant chemists, the taxation system works in a contrary direction.

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Notes & Comments

Chemicals in Food

THE last of the papers read at the 1951 conference on chemicals in food has now been published (*Chemistry & Industry*, 1952, **22**, 484-487) and the Society of Chemical Industry is to be praised for having steadily provided space for this subject, no easy undertaking in these days of space shortage. The final paper and Professor H. D. Kay's closing address each afforded a sound, practical summary of the general problem. Mr. Adams, both a chemist and barrister, in dealing with the legal and administrative background, isolated the crux of the problem of control in emphasising the fact that the key to progress is on the scientific front. Laws about toxic substances depend in the first place upon the generally accepted state of toxicological knowledge. He quoted an American opinion on this same subject—that if all the pharmacologists in America spent all their time investigating the safety of new food chemicals used or proposed, the pace of investigation would not even then keep up with the pace of products. Most people will support Mr. Adam's view that scientists and scientific organisations should provide government officials with information about chemicals used in food processing. Officials cannot possibly keep abreast of every new development in the food industry even though they are mainly responsible for keeping our food legislation up to date; it is not enough to leave it to government departments to unearth new problems and find the remedies.

Common Sense

THERE is a full measure of common sense in this plea for full-hearted co-operation. A toxic hazard, like an ugly truth, will always out; ultimately the serious effects must unmask the cause. For all who are concerned in the use or development of useful food chemicals, it is far better that scientists themselves should be the watch-dogs of public safety. Nothing could do more harm over the next decade or so than a series of after-the-event discoveries that certain food chemicals, developed by food scientists, were in fact harmful. It is an old axiom that one mistake makes more noise than ten successes. Professor Kay's suggestion that a new scientific organisation is required to examine the toxicities and other properties of all chemicals proposed as food additives or used in agriculture is equally sound but this may well prove to be a necessity that the country must deny itself. When existing scientific research centres cannot complete their long-promised expansions and when rates of official pay increasingly repel the best men, what early hope is there for entirely new scientific organisations to be founded? We believe ourselves that the total hazard to public health involved in the use of food chemicals is not so great that it cannot be adequately controlled if there is good-willed co-operation between scientists inside and outside the food industry and if information about new substances is made freely available.

Insecticides in America

THE United States is by far the largest testing-ground for insecticides—the size of her agricultural and chemical industries jointly create the world's leading 'race-course' for the various pest control chemicals. There has now been a long enough period since the introduction of the best-known modern insecticides for their usage figures to reflect not only scientific claims as to performance but also the practical experiences of the farmers and growers. For these insecticides the novelty or honeymoon period is certainly over and the main influence in sales maintenance or expansion is that of the results given in previous use. Annual consumption figures recently issued by the U.S. Department of Agriculture, collected by a new office set up in 1950, possess, therefore, exceptional interest. In so large a food-producing area the isolated figure of production or use for almost any agricultural chemical may seem remarkable. We can now compare such figures.

Impressive Totals

USED on a very similar scale, if not actually engaged in a neck-and-neck race, are BHC and DDT, the former with a 12 per cent gamma-isomer basis. In 1949/50, BHC usage was 71,500,000 lb. and that of DDT was 59,000,000 lb. In 1950/51, the respective figures became 80,000,000 and 78,000,000 lb. For the current year, estimated usages are 95,000,000 lb. of BHC and 85,000,000 lb. of DDT. We are apt to assume that the development of these two new insecticides has greatly reduced the consumption of such older pest control chemicals as the arsenates. It is true that if calcium arsenate and lead arsenate are taken separately, they are used on a weight basis to only one-third or half the extent that DDT and BHC is used. But if the two arsenates are added together, the usage figures still seem remarkably impressive: 1949/50, 67,389,000 lb.; 1950/51, 70,785,000 lb.; and 1951/52, an estimated 75,000,000 lb. A few years ago the rate of development of 2,4-D, the selective weed-killer, suggested that it might become a tonnage-product outreaching any of the pest control chemicals. The officially published figures do not show this. The consumption of 2,4-D for the three years is given as 17,600,000; 23,494,000; and 28,000,000 lb.

Work of the NPL in 1951

Chemistry in the Metallurgy Division

THE increasing importance of Britain's defence programme and its impact upon the research work carried out by the National Physical Laboratory at Teddington, Middlesex, is emphasised in the report of the executive committee for 1951, published for the Department of Scientific and Industrial Research (HMSO, 3s.).

In many cases it was found possible to give the maximum assistance to defence departments by a slight change in existing researches, while in others work already on the programme was of sufficient importance to be retained.

A major change during the year was the transfer in August of the bulk of the Engineering Division to the new Laboratories of the Mechanical Engineering Research Organisation at East Kilbride, near Glasgow.

Arrangements to be made for the control of exposure to ionising radiations were discussed at a meeting attended by representatives of the Ministry of Health, the Ministry of Labour, the Medical Research Council and the Ministry of Supply. The services which the laboratory provides in this field cannot be further expanded without special provision for additional staff and it is very desirable that alternative arrangements should be made to deal with the greatly increased volume of protection work which will follow the implementation of the Radioactive Substances Act (1948).

In the Metallurgy Division, experiments on the reduction of titanium tetrachloride with hydrogen have been discontinued, as the temperatures necessary for the reduction of the relatively stable subchlorides were too high. It was confirmed however that titanium of a high degree of purity could be made by reducing the oxide with sufficiently pure calcium.

In the chemistry section of the Metallurgy Division work was continued on the products of de-oxidation of iron with silicon and with titanium. When silicon was the de-oxidant and the quantity of silicon added was in excess of the oxygen present, the product was vitreous silica.

The most widely occurring product of de-oxidation of iron by titanium was the sesquioxide, α Ti_2O_3, but a number of other compounds, such as rutile, anatase (TiO_2), and ilmenite ($FeO.TiO_2$) were also found.

A study was made of the possibilities of high precision absorptiometry, using the spectrophotometer. In the determination of titanium a reproducibility of ± 0.05 per cent was obtained. This technique is therefore able to compete with classical methods of chemical analysis for major constituents and the work is being continued with an investigation of the effect of temperature on the accuracy of the measurements.

Sulphur from Coal Pyrites

The continued scarcity of sulphur has prompted the Brazilian Government to send samples of coal pyrites to pilot plants in Germany where they are being tested for the recovery of sulphur.

Harwell—The First Five Years

Problems of Atomic Energy Research

FROM the 18th century days when John Dalton propounded his atomic theories, until the beginning of the last war, British scientists played a leading part in the evolution of this branch of science. During the war years it became necessary to centralise all practical developments, and to concentrate the leading Western theorists, in America.

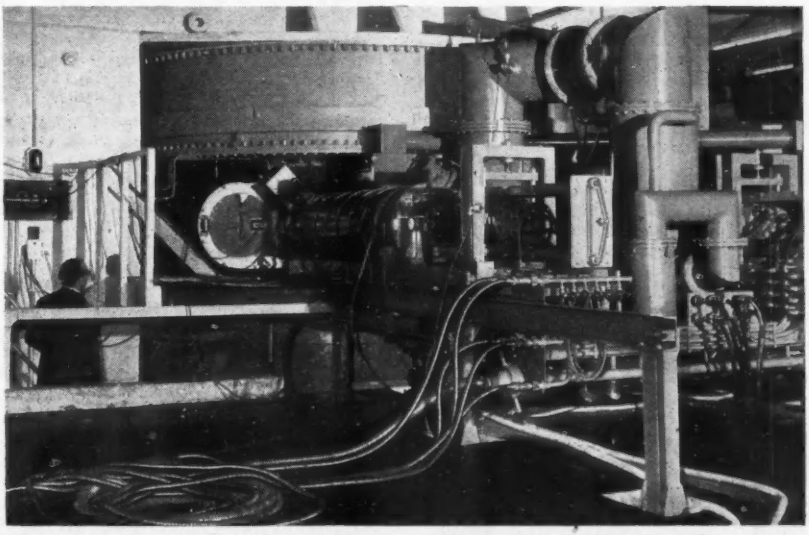
At the end of hostilities, Britain had no means of using or developing the great advances that had been made, except the university laboratories, and it became evident that a national effort was necessary to reap the benefits of previous work.

In 1945, the Prime Minister announced that the Government had decided 'to set up a research and experimental establishment covering all aspects of the use of atomic energy', and in January the following year Dr. J. D. (now Sir John) Cockroft was appointed director and building began in April.

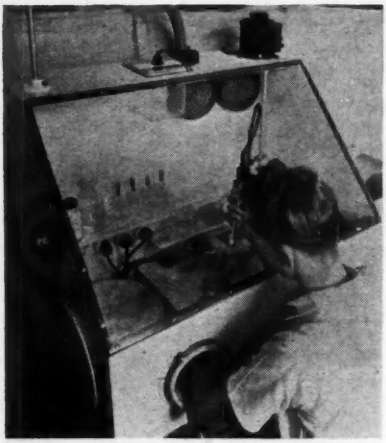
The first connected story of the work and problems of the Atomic Energy Research Establishment (now familiarly known as AERE) from its inception in 1946 to the end of 1951, has now been given in 'Harwell' (128 pages, 32 photographs, nine sketches and diagrams), prepared by the Ministry of Supply and the Central Office of Information, and published by Her Majesty's Stationery Office, price 6s.

A primary difficulty in discussing a specific programme at Harwell is that not one of them is self-contained. Pile development work for the production programme, for example, contributes to the reactor programme; and the development of the chemical separation plant will bear upon the processing of nuclear fuels for future reactors.

The first reactor built at Harwell was the Graphite Low Energy Experimental Pile, colloquially known as Gleep. Construction was started in the autumn of 1946, only a few months after the site had been taken over. The pile first operated on 15 August, 1947, and since then has been in continuous use, most of the time running 24 hours a day.



The 110-inch synchro-cyclotron, showing a feeder line leading into the vacuum chamber between the magnet pole-pieces



Using a micropipette in a dry box

Gleep is a slow neutron reactor using graphite as a moderator and natural uranium and uranium oxide as fuel. A fairly full description was published in December, 1950.

For isotope production and for many experimental purposes, a pile having a stronger neutron flux was necessary, and for this reason construction of the second Harwell pile, the British Experimental Pile O (Bepo) was undertaken. It was started up on 3 July, 1948, and a description published in April, 1951.

The importance of chemical research in the development of piles, as distinct from the separation of fissile material, is perhaps not so obvious as that of research in physics or metallurgy. Nevertheless a great deal of work has been done by the Chemistry Division at Harwell in various directions.

In the first place the need for materials of high purity has demanded the development of special analytical techniques especially for the determination of uranium, plutonium, and certain elements which are harmful in the operation of piles. Then the chemistry of certain elements which had hitherto been of comparatively little importance because of their rare occurrence has had to be examined in far more detail; this includes many of the elements in the middle of the periodic table, especially the rare earth elements, which occur among the fission products.

Another problem confronting the chemist has been the chemical behaviour of graphite and carbon at comparatively high temperatures and in the presence of high intensities of radiation.

The chemical difficulties of separating the fission products from the uranium and plutonium are extremely complicated. Plutonium itself is, of course, radioactive and also is very poisonous.

Every operation in the process has, therefore, to be done by remote control, with thick shields between the operators and the materials, and every conceivable leakage must be anticipated in the design. Such stringent requirements present the chemical engineer with difficulties probably greater than any he has had to overcome before.

It can be readily imagined that for even laboratory-scale experiments on this process workers must be particularly well protected against radiations and radioactive materials. Ordinary chemical laboratories are quite unsuited to the work and well-shielded cells elaborately ventilated are necessary. Such a laboratory takes some time to build and some three years elapsed after Harwell was formed before the Chemistry Division had suitable, and sufficient, premises in which to carry on the programme of experiments in separation. Now the Division's 'hot' laboratory is one of the most up-to-date in the world.

Anglo-Canadian Co-operation

Until the laboratory was ready, however, work on the chemical separation process was carried out mainly at Chalk river in Canada. Indeed, the development of this process exhibits one of the best examples of the close collaboration between the British and Canadian projects.

The impact of the discovery of nuclear fission (which was made by chemists) upon fundamental chemistry has been nearly as great as upon fundamental physics. First it has widened the field of radiochemistry, presenting it with a vast number of new radioactive elements and isotopes and demanding from it a considerable extension of techniques. Then it has focused attention on the hitherto neglected chemistry of the heavy elements, especially uranium and thorium, and has, moreover, added to them a whole series of artificially created elements, heavier than any known in nature, namely, neptunium (atomic number 93);

plutonium (94); americium (95); curium (96); berkelium (97); and californium (98).

Finally, the technical requirements of pile design and of the separation of fissile material have raised new fundamental problems in radiation chemistry and have led to advances in the understanding of solution chemistry and ion exchange phenomena, and to extensions in the techniques of chemical analysis.

One of the most widely publicised aspects of work on atomic energy both in the U.K. and abroad, is the use of radioisotopes in medicine and industry. In fact the production of such isotopes is essentially a by-product of work on atomic energy and more or less incidental to the operation of piles, but because their application in research was already understood, immediate advantage could be taken of the vastly increased scale, and range, of production made possible by nuclear reactors.

Method of Irradiation

The method of irradiating samples at Harwell is quite simple. A quantity of the sample, usually in the form of a metal or salt, is weighed out into a cylindrical can, which is then placed in a graphite block and pushed into one of the 'isotope holes' in Bepo. The graphite blocks are inserted and removed through a massive lead tunnel and transported in lead or steel containers to protect the operator against radiation.

Normally samples are loaded into the pile each Monday and are irradiated for some multiple of a week. If an irradiation is for a short period only, the sample is shot into and out of the pile with pneumatic equipment.

When removed from the pile both the sample and can are active and have therefore to be handled from a safe distance by means of remote handling equipment. Radiation monitors are used as routine precautions against damage to the health of the operator.

Production of radioisotopes first began at Harwell in September, 1947, using Gleep, but was transferred to Bepo in February, 1949. A steadily increasing proportion of the production is exported. Deliveries in 1951, were on a scale of 800 a month compared with less than 100 in 1948.

In any laboratory devoted to the study of atomic nucleus a conspicuous place is taken by machines for accelerating elementary particles to higher energies. Particle accelerators are necessary to the nuclear physicists because one of his most powerful methods of studying the nucleus is to examine the interactions between it and the various elementary particles, moving with all energies from a thousandth of an electron volt up to, in the future, thousands of MeV.

Among the cyclic accelerators, the biggest machine at Harwell is the 110 in. synchro-cyclotron (or frequency-modulated cyclotron), the largest so far operating in Europe.

One of the major technical problems in all atomic energy works is the protection of the workers from damage to their health by the various kinds of radiation that are inseparable from such work.

Dangers are more insidious than most of those confronting the plant engineer; for example there are few chemical poisons which do not give some indication to the five senses and which would not be stopped by a six-inch concrete wall, but a beam of neutrons from a cyclotron cannot be smelt, heard, or seen, and requires several feet of concrete to stop it.

Injury caused by radioactivity may not be apparent for a long time—sometimes for years—but nevertheless is severe and may prove fatal. Harm may be done either by a single large dose of radiation or by frequent doses of very much lower intensity, for example by daily exposure in a laboratory. Safety is therefore only attained by constant vigilance.

Isotope production in Bepo

Protective measures are taken to ensure that the worker cannot breathe air containing a dangerous concentration, or collect radioactive materials on his hands or skin or clothes. All sorts of precautions from simple gas-masks to the elaborate air-conditioning of the 'hot' chemistry laboratory are used to remove active gases, and persons working with radioactive material wear protective gloves and other clothing.

Where the material is exceedingly active, the two sorts of precautions are combined and all operations are performed by remote control in screened cells, the manipulations being watched by means of periscopes.

When all these precautions have been taken there still remains the question, have they been effective? Or has anyone inadvertently been exposed to a dose greater than tolerance? At Harwell a monitoring and checking service is provided by two organisations, the Medical and Health Physics Divisions. Roughly speaking, the former makes clinical examinations and biochemical tests to ensure that the standard of health is maintained and to detect any damage at an early stage; the latter is responsible for controlling the levels to which workers may be exposed.

Furfural from Cocoa

Gold Coast Sample Investigated

PREPARATION of furfural from cocoa husks does not appear to be an economic proposition. This is the conclusion arrived at following the examination of a sample submitted for investigation by the Horticulturist of the Department of Agriculture, Gold Coast, to the Colonial Products Advisory Bureau.

Results of the examination and conclusions are summarised by R. W. Pearman, Dr. W. D. Raymond, and Miss J. A. Squires in *Colonial Plant and Animal Products* (Vol. II, No. 3, 1951), the quarterly journal of the Colonial Products Advisory Bureau (Plant and Animal) published by Her Majesty's Stationery Office (price 5s.).

In the preparation of cocoa beans for export large quantities of husks are produced as a waste product. The term husk denotes the pod-case which originally contained the pulp and cocoa beans in their shells.

The sample consisted of the husks from eight pods, each broken into halves and being originally approximately 14 cm. in length and 8 cm. in breadth. The thickness of the husks varied from 0.2 to 0.8 cm. They were externally dark brown in colour. The husks were very moist and a considerable amount of greyish-white mould was present.

Half the sample was dried in an oven until the husks were friable, and then ground in a mill to a fine powder. The analysis was as follows:—

	On sample as received Per cent.	On moisture-free material Per cent.
Moisture (loss on drying at 100° C.)	4.61	—
Fat (material soluble in ether)	1.16	1.22
Furfural Yield,* ..	8.6	9.0
Pentosan Content (by calculation)	14.7	15.4
Crude Protein (N x 6.25)	5.5	5.8
Ash	10.6	11.1
Theobromine (qualitative)	not detected	

* 'Methods of Analysis, Assoc. Off. Agric. Chem.' 6th Edn., p. 412.

Potential furfural yield of this material is much lower than that of oat hulls (21 to 23 per cent), corn cobs (23 to 24 per cent), and cottonseed hull bran (20 to 23 per cent), determined by a similar analytical procedure. These materials are utilised in industry in this connection. Groundnut husks have a comparable yield (10 to 11 per cent) giving a process yield of 5 to 6 per cent. The utilisation of the latter material has been seriously advocated, but firms interested in promoting furfural production regard such an undertaking as at best marginal.

It can, therefore, be concluded that the exploitation of cocoa husks as a source of furfural would be marginal assuming the raw material to be almost without cost. While this assumption is true for the husks on the site of dehusking, the transport of the husks to a central processing plant might be an expensive operation and hence the proposal to prepare furfural from this waste does not appear economic.

No other constituent appears to be present in quantity sufficient to be attractive commercially. The nitrogen content is low and while the material contains approximately 10 per cent of ash, the latter is mainly of an inert siliceous nature.

Philippines Chlorine Project

Construction of a factory near Manila to produce chlorine and caustic soda is progressing. The whole scheme will cost about $1,000,00. The plant will probably produce six tons of chlorine and NaOH a day.

Textile Dye Wastes*

by NELSON L. NEMEROW
(Assistant Professor of Sanitary Engineering, North Carolina State College)

THE pollutional character of textile dye wastes depends upon the type of dye used, which in turn depends to a great extent upon what kind of cloth is being dyed and the specifications of the finished dyed cloth. The main dyes are (1) Direct colours. (2) Sulphur colours, (3) Vat colours, (4) Acid colours, (5) Developed colours, (6) Naphthol colours, (7) Acetate colours.

Direct Dyes are very commonly used because the colours are water-soluble and can be applied directly to cotton, often with the aid of 10-40 per cent NaCl or Glauber's salt based on the weight of goods being dyed. These dyes are mainly azo dyes, derivatives of benzidine or tolidine. The amount of dye used varies with the colour and intensity; it varies from 0.1 to 8 per cent of the weight of the goods dyed. In a few instances common salt is also added in the last rinse before drying to increase the retention of dye in the fibre. The major portion of the solids, then, are mainly inorganic salts even though they are highly coloured due to the small quantity of very soluble dyestuff. In addition to the dyestuff and salt, oils of various sorts are used by some mills. These oils act to reduce the surface tension between the water and the cotton and make the latter more absorbent.

In spite of the varying practices that produce different quantities of wastes the pollution contributed from machines accommodating definite amounts of cotton is about the same regardless of the volume of the combined wastes wherever the waste values are expressed in lb. per 100 lb. of goods.

Direct dyes are mostly used in vegetable fibres, such as cotton and rayon. The wastes, containing a large amount of common salt, when in a large volume and not strongly diluted by sewage, may be corrosive to metallic equipment in sewage treatment plants.

Sulphur Dyes are so-called because they consist of sulphur compounds and are dyed as a rule with the addition of sodium sulphide and common salt to the bath. The chemical nature of the sulphur dyes is still more or less undetermined, but it is probable that they consist of a mixture of complicated organic derivatives, in which sulphur appears to be a constituent part. The principal sulphur colours are blacks, browns, blues, yellows, and greens. The affinity of these dyes for the cotton fibres is relatively poor and a high concentration of dye must be maintained in the bath, and consequently an unusually high concentration of sulphur dyes is often discharged. They have moderate-to-good fastness to light and washing. They also furnish deep, heavy shades on cotton.

Wetting Agent Used

In preparing the cotton for the dyeing operations some mills employ a wetting agent to render the fibres thoroughly absorbent. In addition to the dyestuff and sodium sulphide varying amounts of sodium carbonate are added to raise the alkalinity to aid in dissolving the dye. And, as in dyeing with direct dyes, salt is added during the dyeing period to aid in the exhaustion of the colour to the cotton. Sulphur dye wastes are particularly objectionable when discharged to a stream or to a municipal sewage treatment plant. They still contain considerable colouring matter and discolour the stream. They are highly alkaline and for this reason tend to destroy the biology of the stream and the functioning of the sewage treatment plant. They have a high immediate oxygen demand and deplete the dissolved oxygen. The sodium sulphide hydrolyses to set free hydrogen sulphide, which has a very disagreeable odour, objectionable in stream or treatment plant.

Vat Dyes are applied in a special kind of dye bath in which the dye is reduced to a soluble form by means of a strong reducing agent, such as hydrosulphite. The dyes themselves are highly insoluble in water, but readily yield products on reduction

**This paper was presented at the Seventh Industrial Waste Conference held at Purdue University, Lafayette, Indiana, 7-9 May. The editor is indebted to the organisers of the Conference and to Professor Nemerow for permission to publish it. Altogether more than 40 papers were read and these will be published by the university in the proceedings.*

which are soluble in alkaline liquids. The dye bath, therefore, consists of a mixture of the dyestuff, a strong alkali, and such a mixture is termed a 'vat'. The vat dyes are characterised in general by great fastness to light, washing, acids, alkalies and in many cases to bleaching with hypochlorite. The vat dyes have come to be very essential dyes for cotton, as it is chiefly by the use of these dyes that laundry-fast colours in cotton fabrics are obtained. They are necessary dyes for the production of colours in shirtings, house dresses, children's clothes, work clothes, and such fabrics or garments that require frequent laundering.

Oxidising Solutions

After the dyes are adsorbed by the goods the material is oxidised with one of several types of oxidising solutions such as sodium bichromate and acetic acid, perborate of soda, and hydrogen peroxide. It is then treated at the boil with soap or detergent and alkali and finally rinsed. In the application of a vat colour there are three distinct processing liquors; the dye liquor, the oxidising bath liquor, and the soap bath liquor, producing three principal wastes.

Acetate Dyes are primarily used for acetate rayon, but are also of importance in dyeing nylon and other newer synthetics. Most of the dyes are not soluble and are applied from a bath containing a dispersion of the finely divided insoluble dyes in the presence of soap, synthetic detergents, or soluble oils.

Naphthol Dyes are extensively used for fast reds on cotton and give a very brilliant colour. The naphthol colours are azo dyes built up on the fibre by first treating with a developer and then with a diazotised solution of a suitable base. In the application of a naphthol colour there are always two major wastes produced; one, the developer waste (alkaline) and the other the diazotised dye liquor. Since the use of a hot soap solution tends to brighten the colour and soda ash to deepen the shade, these substances may be found in one or more such baths discharged following the dyeing.

These dyes are all of importance in North Carolina to-day.

In the manner of a condensation it can be stated that the following are the predominant pollutional characteristics of the textile dye wastes in North Carolina.

(1) Intense colour and surface unsightliness.
(2) High *p*H and alkalinity.
(3) High chemical oxygen demand.
(4) High chlorine demand.
(5) High temperature of dye wastes.
(6) Extreme toxicity of sulphur dye wastes.

It is very interesting to note that in 1950, in a study conducted by Wesleyan University it was recommended to the New England Interstate Water Pollution Control Commission that 'an engineering survey into the possibility of adequately designing new municipal sewage treatment plants to handle the wastes from textile mills in their respective areas be conducted'. This suggestion was made in view of the increasing construction of municipal treatment plants in the compact area. It is our aim in North Carolina not to wait until we haven't any land left to adequately treat our wastes nor time left to seek an economically feasible solution, but to study the possibilities of combined and separate textile waste treatment now.

In North Carolina we are faced with the problem of dealing with the wastes from many relatively small textile mills instead of a few large mills. This immediately poses the limitation of funds and extent of treatment upon the mills. It then naturally follows that the wastes from small or medium-sized mills can most economically and feasibly be handled by the municipal treatment plant.

Necessary Treatments

There are at least five ways in which a textile dye waste must be treated between the time it leaves the processing room at the mill and when it is discharged into our municipal sewers, through the city treatment plant and thence into our rivers which we desire to keep clean.

(1) *Equalisation of the wastes*—essentially a process of mixing strong ones with weak ones.

(2) *Neutralisation of wastes*—mixing acid wastes with alkaline ones or using some other method of neutralisation.

(3) *Proportioning the waste flow to domestic sewage flow*—the discharge of large quantities of waste when the city sewage flow is high.

(4) *Removal of coloured matter from the wastes*—a process to make the waste appear clear and clean to the human eye.

(5) *Removal of oxygen- and clorine-demanding matter from wastes*—usually a

combination of aeration, chemical precipitation, and biological oxidation.

When the textile dye wastes are to be treated along with the domestic sewage, the equalisation, neutralisation, and proportioning can be controlled by the textile mill while the removal of colour, chlorine- and oxygen-demanding matter can best be handled at the municipal plant. The location of the treatment is rather one of convenience and good judgment than one which fixes the financial responsibility.

Specific Example

A meeting was called last November in Salisbury, North Carolina, to map out a method of research and field investigation concerning the treatment of the dye wastes from the Salisbury Cotton Mill and the domestic sewage from the city of Salisbury. The meeting was attended by representatives of the city, the mill, the designing engineer, the newly-formed North Carolina Stream Sanitation Committee and the author. It was decided by all that, after the mill personnel had been indoctrinated in the importance of equalisation, neutralisation, and proportioning, a 48-hour sampling period at the existing municipal plant be scheduled.

The sampling period was separated into 24 hours with no mill waste whatsoever entering the municipal plant and 24 hours with the mill waste coming in in its greatest volume and most pollutional form. Sulphur dyes, which the mill used entirely during this period, were selected as the most objectional waste to be discharged by the mill. Each hour a sample of the raw waste entering the plant was collected and analysed for pollutional characteristics. These results provided us with two curves for each type of pollutional characteristic over the entire 24 hours. One curve was the baseline curve or the domestic sewage alone, while the other showed the effect of the mill waste on the domestic sewage. It was then possible to determine what percentages of the total pollutional loads were contributed by the mill and at which times during the day such loads could best be assimilated by the city sewage. A 24-hour sewage-waste composit sample was brought back to our laboratories at North Carolina State College and a laboratory research study began designed to relate whether chemical treatment could be used to effectively remove colour and other organic matter.

It was found that aluminum sulphate ($Al_2(SO_4)_3.18H_2O$) completely removed the visual colour from the mixture and also reduced the five-day biochemical oxygen demand 63 per cent. The dosage of alum required was 200 parts per million at the existing *p*H of 8.3 and 140 parts per million at a *p*H of 7.0. The dosage is not considered excessive for the results it produced. This form of pretreatment was found to be superior to acidification or chlorination and chemical coagulation with either lime or ferrous sulphate.

On 31 January of this year a third 24-hour field investigation was carried out in a manner similar to the first sampling period. This investigation was designed to verify the previous results and to demonstrate the effect of additional efforts by the mill to equalise and proportion their waste flow. It was found that the variation between the peak flow which occurred at noon and the minimum low flow which occurred at 4 a.m. was 100 per cent. It is, therefore, quite important that the plant be designed to handle the peak and not the average loads. It was also concluded that the mills' method of proportioning the dye waste according to the sewage flow eliminated any type of shock pollution from reaching the plant during the period of low domestic flow. The pollutional load and character of the Salisbury Cotton Mill waste was further verified. It was found that the colour and chlorine demand of the mill waste were the main pollutional characteristics, but biochemical oxygen demand and relatively high *p*H of the waste were also of some concern.

Laboratory Research Project

The laboratory research project following this sampling period showed that the combined sewage and dye waste was treatable by biological methods either before or after chemical treatment with alum. The optimum combination of chemical treatment followed by biological treatment reduced the 5-day biochemical oxygen demand over 86 per cent, caused a colour reduction of 83 per cent as measured electrically, and effected a 60 per cent reduction in chlorine demand. Alum required in the primary chemical treatment was 120 p.p.m. which was 27 per cent higher than that required in secondary chemical treatment when alum was used following biological purification. Alum treatment alone, as a primary device,

caused 67 per cent B.O.D. reduction, 86 per cent colour reduction, and 48 per cent chlorine demand reduction and resulted in an effluent with a *p*H of 7.3.

A meeting was then held with the designing engineers and the stream Sanitation Committee to review the research results and to discuss the design of the combined treatment plant. It was decided that the plant would be designed as follows:—

(1) For an average flow of 4.0 mgd. with provisions for handling flows of 50 per cent above and below the average.

(2) To be of the high rate trickling filter type.

(3) To be composed of:—

A. Bar Screen, mechanically cleaned.

B. Grit removal basin.

C. Two combination pre-aeration flocculator and primary clarifier basins; one hour retention in aerator-flocculator and two hours retention in clarifier and air supplied at the rate of 0.25 ft.^{3}/gal. of sewage.

D. Chemical feed and storage building equipped to feed alum and sulphuric acid with provision for future feeders. Alum feed lines will be both to the primary and secondary clarifiers, and sulphuric acid to the primary clarifiers and trickling filters.

E. Flash mixer with a one minute retention time.

F. Two trickling filters with B.O.D. loadings of 2,500/acre ft. and recirculation rates up to 4:1 with provision for returning varying quantities of sewage to the primary clarifiers during low flows.

G. Secondary flocculator with a 30-minute retention period.

H. Secondary clarifier with a 2-hour retention period.

I. Chlorine contact basin with 15 to 20-minute retention and with over and under baffles. The chlorine is to be applied ahead of secondary flocculator and in the chlorine contact basin.

J. Sludge digesters and control buildings, equipped for heating, with a digester capacity of 3.5 ft.^{3}/capita (40,000 people).

K. Sludge nitrifying aeration basin to receive all of the secondary sludge and all of the digester liquor for the purpose of converting the ammonia of the digester liquor to nitrites and nitrates for return to the filters and/ore ahead of the primary clarifiers. This basin will have an 8-hour retention period with air supplied at the rate of 60 ft.^{3}/min.

L. Sludge drying beds with one sq. ft. per capita.

As soon as the preliminary estimates of cost have been prepared, a meeting will be arranged between all parties concerned to determine the proportion of the cost of construction and of operation of the plant which is required for the combined treatment. Proportionate costs to be shared by the mill and the city will be discussed.

In summary, it should be stated that one way in which the textile dye waste problem can be solved is by joint municipal and industrial waste treatment. The type, volume, and sanitary characteristics of the dye waste as well as the flow pattern and character of the domestic sewage must be ascertained. A laboratory research investigation can then be used to determine methods of treatment of the combined sewage-dye waste mixture. This must be followed by proper design based on the field investigations and laboratory research results. Lastly, but of great importance, is the agreement between the city and its industry as to the proportionate costs of construction, treatment, and maintenance to be shared by each.

Acknowledgement

The writer wishes to express his appreciation to the North Carolina Stream Sanitation Committee for making available men and resources to help carry out the study, Mr. Kenneth Campbell, of North Carolina State College School of Textiles, for his assistance in the review of the modern textile dye practices, Mr. Dave Smiley, of the Salisbury Cotton Mill, for his co-operation and understanding of the problems involved, Mr. John Lesslie, representing the city of Salisbury, for his time and effort in making this study a successful one and lastly, but very important, Mr. Dan McConnell, Plant Engineer for the Cone Mills, for his foresight in instigating this project for his owners.

IN THE EDITOR'S POST

Electron Micrographs in Colour

SIR,—On 15 March, 1952, you published an abstract of a paper which was presented at the 9th annual meeting of the Electron Microscope Society of America. This published account was attacked by the Editor of the *British Journal of Photography* as being misleading in an editorial in the issue of 4 April, 1952.

Nothing could be further from the truth. This article was written in an explicit and straightforward manner giving the full details of the processing of electron microscope pictures. It was specifically stated that an electron beam contained no colour and nowhere in the paper was it either stated or implied that the colours arising in the processing were the true natural colours.

The second mistake which the Editor of the *British Journal of Photography* made was his hasty assumption that Bensley's discovery was not new. He states 'Surely Carey Lea's photochemical researches on red and purple silver chloride, etc., cover the phenomena that Mr. Bensley is supposed to have discovered. Possibly he, and the authors of the paper on electron micrographs, are unaware of Carey Lea's paper on "Allotropic Forms of Silver," which was published in the *American Journal of Science*, 1889, Vol. 37, p. 476.'

In answer to this, so that the true facts of the case may be known, may I state that the materials responsible for the colours in this process are neither Carey Lea's red and purple silver chlorides nor are they Carey Lea's allotropic forms of silver. Their reaction to the solvent action of a sodium thiosulphate solution is identical with that of any developed photographic silver lying in an emulsion. In order to prove that they are not Carey Lea's allotropic forms of silver I quote from his paper in the *American Journal of Science*, 1889, Vol. 37, p. 480.

'*Properties possessed by all the varieties in common and distinguishing them all from normal silver.*

'*The action of acids.*—The stronger acids, even when much diluted, instantly convert the allotropic forms of silver into normal gray silver; even acetic acid, not too much diluted, does this.'

Since the silver producing the colours in the Bensley process does not change into normal gray silver upon treatment with strong acids it is not any of the allotropic forms described by Carey Lea. Coloured plates can be submerged in glacial acetic acid for weeks without a loss of the colours. Concentrated sulphuric acid has no immediate direct effect upon the colours. The colour degradation occurring with this acid is due to the indirect effect of the strong acid upon the gelatin.

I am sending you some of my coloured electron micrographs so that you may show them to any who are interested in seeing them. I will also be happy to furnish similar samples for the Editor of the *British Journal of Photography* so that he can repeat the simple tests which I have described.

It is indeed regrettable that the Editor of such a well-known journal as the *British Journal of Photography* would jump to such unwarranted conclusions without attempting to obtain the facts.—Sincerely yours,

GEORGE W. COCHRAN.

Research Associate Professor,
Utah State Agricultural College.

Editor's note: Professor Cochran has sent us two of his coloured electron micrographs —one of rat sperm magnified 7,000 *times and the other of guinea pig sperm cell magnified* 8,000 *times—and we would be glad to show them to anyone interested.*

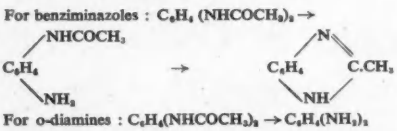
* * *

4 : 5-Dihydroglyoxaline

SIR,—In 1930 (*J.C.S.*, 1930, 1409-1419) the writer showed that diacetyl-*o*-diamines on hydrolysis with mineral acids or caustic alkalies gave mixtures of the corresponding benziminazoles with mono acetyl-*o*-diamines and that the latter is transformed to the former simultaneously.

The further observation was made that, if hydrolysis of diacetyl-*o*-diamines was done using alcoholic hydrogen chloride, only the diamine was formed and this is due to the elimination of the acetic acid as methyl acetate. Thus, if the benziminazole is wanted, it is necessary to employ aqueous mineral acids (or aqueous caustic alkalis) and if the diamine is wanted, it is necessary

to use alcoholic hydrogen chloride:


For benziminazoles : $C_6H_4(NHCOCH_3)_2 \rightarrow$
C_6H_4 $NHCOCH_3$ NH_2
C_6H_4 N $C.CH_3$ NH
For o-diamines : $C_2H_4(NHCOCH_3)_2 \rightarrow C_2H_4(NH_2)_2$

Attention was also called to the possibility that glyoxalines would be formed if diacetyldiaminoethylenes were hydrolysed with mineral acids; Windaus, Dorries and Jensen (*Ber.*, 1921, **54**, 2754) had shown that the action of methyl alcoholic hydrogen chloride on diacetyldiaminoethylenes gave amino-ketones (by intramolecular change).

We have now in fact shewn that if the diacetyl derivative of ethylene diamine is heated with 15 per cent hydrochloric acid, 4: 5-dihydroglyoxaline is formed (as the hydrochloride) in good yield.—Yours faithfully,

M. A. PHILLIPS.

Dr. M. A. Phillips and Associates,
Romford.

Royal Interest Continues

THE continued interest taken by members of the Royal Family in the work of the John Benn Boys Hostels Association was again exemplified at the annual dinner at the May Fair Hotel, London, on 4 June, when His Royal Highness the Duke of Gloucester was the guest of honour. The occasion was rendered all the more notable by the fact that it was the Silver Jubilee dinner of the Association—which came into being in memory of Sir John Williams Benn, as a result of the initiative of his son, Sir Ernest Benn—and the Earl of Derby presided over a distinguished company numbering nearly 250.

The Duke of Gloucester proposed the toast to the continued success of the Association to which Mr. John Benn replied. Sir Arthur fforde, headmaster of Rugby school, proposed the toast of 'The London Boy' to which Mr. Harold Clarke responded. The Earl of Derby gave the toast 'The Guests" and Mr. Beverley Baxter responded. £1,422 was collected at the dinner for the Association.

Birthday Honours

THE first Birthday Honours conferred by the Queen were announced on 5 June and the list included Mr. Henry James Ross, the chairman of The Distillers Co., Ltd., who receives a Knighthood. Also included in the list were the following:—

Ordinary Commanders of the Order of the Bath: B. G. Dickins, O.B.E., Director of Technical and Personnel Administration, Ministry of Supply; N. G. McCulloch, chairman of Council, British Cotton Industry Research Association; W. A. C. Newman, O.B.E., chemist and assayer, Royal Mint; H. E. Snow, deputy-director Anglo-Iranian Oil Co., Ltd.; D. T. A. Townend, Director-General, British Coal Utilisation Research Association.

Ordinary Officers of the Order of The Bath: J. Brooks, Principal Scientific Officer, Low Temperature Research Station, DSIR; H. G. Davey, Works General Manager, Atomic Energy Production Factory, Sellafield; J. M. Hattrick, managing director Potash, Ltd.; Robert Higgins, assistant professor of metallurgy, University College, Swansea; G. Noble, manager Fawley Refinery, Esso Petroleum Company; A. A. Pratt, chairman, Southern Oil Co., Ltd.; R. L. Stubbs, secretary British Non-Ferrous Smelters' Association; K. B. Ross, lately general refineries manager, Anglo-Iranian Oil Company, Persia, and M. Wilcocks, manager, Anglo-Egyptian Oilfields Refinery, Suez.

Ordinary Members of the Order of The Bath: H. L. Edwards, lately Command Analyst, Royal Air Force, Iraq; J. H. Freeman, J.P., lately manager Coryton Oil Installation, Vacuum Oil Company; T. J. Gale, designer, Pulsometer Engineering Company; J. A. Press, manager, Bakelite, Ltd., Aycliffe; and A. R. Wakeham, technical officer, Petroleum Division, Ministry of Fuel and Power.

British Empire Medal: Joseph Davies, boilermaker, Imperial Chemical Industries, Liverpool; F. A. Scott, staff foreman, Tar and Ammonia Products Works, North Thames Gas Board, Beckton.

Zinc Oxide for Chilean Industry

A zinc oxide plant has been established in Viña del Mar by Messrs. Blundell, Spence & Cia. (Chile), S.A. Production is estimated at about 30 tons monthly of the red seal and will be used almost exclusively by the Chilean industry. Later on it is expected that other grades will be produced.

German Chemical Trade Recession

Sales Recovery Fails to Materialise

THE hoped-for recovery of German chemical sales has failed to materialise, apart from a seasonal improvement in products of interest to the building trades, and many chemical manufacturers now experience a repetition of the trade pattern in the spring of last year when the Korea boom gave way to a recession in March-June. They hope that the second half of 1952 will see an improvement, but some sections of the chemical industry, especially those working for the textile, leather and paper industries, are faced with the need for a substantial reduction of outputs. Firms which enlarged their plant to meet seemingly increasing requirements of their customers find that they have overestimated the demand.

The production of Phrilon, a new fully synthetic fibre, has started on a commercial scale at the Neumuenster works of Strohzellstoffwerke AG, and another new fully synthetic fibre called Phrilon II has now been produced on a laboratory scale. The latter is described as opening the road to synthetic wool. Not only does it resemble wool in appearance and thermal insulation, but it can be washed warm and does not felt. Cassella Farbwerke Mainkur AG have developed the Rein-Zerweck process for a polyaerylonitrile fibre (PAN) to a stage where it can be applied on the industrial scale, and are reported to have obtained finance for the erection of a commercial plant for the new fibre in the Regensburg area of Bavaria.

Similar Problems

Rayon staple and filament producers in West Germany are faced with similar problems to their foreign competitors. The price fall of wool and cotton has reduced the interest of German textile manufacturers in synthetic fibres. One big rayon works, at Siegburg, closed down completely in April and is now working at half its capacity, while another plant at Krefeld has been mostly working short-time since October. In view of the textile slump, processors are unwilling to invest large sums in new machinery for the use of perlon yarn, production of which is still increasing despite the declining demand for other textile materials, especially as perlon and perlon-reinforced stockings are being illegally imported into West Germany from the Soviet zone where perlon is being produced at Schwarza, Thuringia.

Synthetic Rubber Output

The synthetic rubber output of Chemische Werke Huels at Marl has had to be cut from the initial level of 500 tons a month to 300-350 tons because of rising stocks, and the Government has imposed a levy on all natural and imported synthetic rubber as well as latex in order to reduce the price differential between natural and home-produced synthetic rubber. The latter is now being sold at Dm. 4.60 a kilo compared with less than Dm. 3.00 for natural rubber. The levy of Dm. 0.12 per kilo is payable with retrospective effect from 1 April, also on stocks held on that day, while consumers of home-produced buna will receive a subsidy of Dm. 1.60 per kilogram. The subsidy, it has been explained, will enable the Huels works to increase their production, with a consequent lowering of producing costs which should also benefit from the projected change from coal to hydrocarbon oils as the raw material.

A new company for the production of synthetic phenol has been formed by an industrial group including Scholven-Chemie AG and Rütgers-Werke AG. Production is to be by a new process based on benzole and oil refinery by-products. Unofficial reports speak of co-operation with a foreign group, while production is expected to start shortly in an existing plant hitherto used for a different purpose.

The segregation of the I.G. Farbenindustrie units has now been virtually completed. In addition to the three large successor companies—Farbenfabriken Bayer AG, Leverkusen; Badische Anilin- und Sodafabrik AG, Ludwigshafen; and Farbwerke Höchst AG vorm. Meister Lucius and Brüning, Frankfort-Höchst-Cassela Farbwerke AG Mainkur, Chemische Werke Hüls AG, Titangesellschaft mbH at Leverkusen, Kalle and Co. AG, Wiesbaden-Biebrich, Dr. Alexander Wacker Ges. für Elektrotechnische Industrie mbH, Munich, Dynamit

AG, Troisdorf, and Wasag-Chemie AG, Sythen operate works in various sections of the chemical industry, while two companies —Duisburger Kupferhütte AG and Agfa Camerawerk AG, Munich, have no direct connection with the chemical industry proper. Agfa AG für Photofabrikation and two fluorspar and barytes producers have been attached to the Bayer company, while the important Knapsack-Griesheim AG für Stickstoffdünger und Autogentechnik forms a subsidiary of Farbwerke Höchst. There is no doubt that the three big companies domiciled at Leverkusen, Ludwigshafen and Höchst will play a dominating rôle in the German chemical industry of the future.

New Moulding Technique

Ex-German Process Developed in U.S.

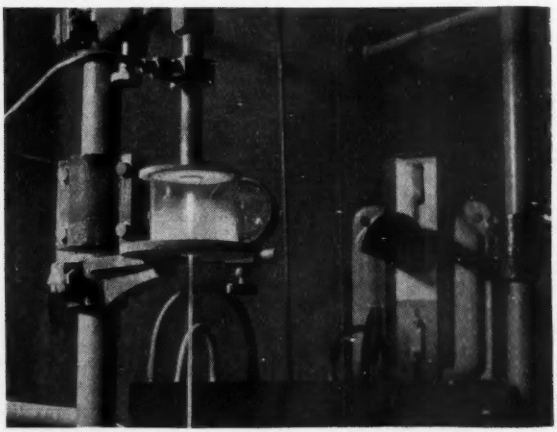
THE process of shell moulding, first publicised five years ago in a report from the Allied Military Government for Germany, brings together sand and resin under the influence of heat to obtain a light, preformed facing from which a complete mould can be made. But while the process as originally announced offered great promise in cost savings, higher foundry efficiency, and cleaner foundry operations, its major handicap was the lack of equipment for turning out the light-brown moulds on a mass production basis.

Now however, as a result of intensive experiment and development work, machines which simplify the shell moulding process to a push-button operation are being produced in the United States. Some of these will make up to 60 moulds an hour, and as a result the number of foundries using the shell moulding process has shown steady increase over the past year. Many more have the technique under study and in pilot plant operation.

The operation is being promoted by the Monsanto Chemical Company, the Bakelite Company and the chemical division of the Borden Company. Their interest lies in the high volume of resin consumption possible if foundries adopt the process.

The technique calls for baking a dry phenolic resin sand mixture in lubricated and heated metal patterns, the resin serving to hold the sand together. When the shells are complete at the end of the cycle, they look much like a platter of brown baked goods removed from a baker's oven. The two halves of the shell are then placed together and sealed, and metal is poured into the mould thus formed. The resin burns as the metal solidifies, and the mould tends to dissolve.

Shell moulding is said to be particularly well-suited to aluminium, grey, nodular and malleable iron, low-leaded, low-tin bronzes and high alloy steels. Original casting limitations of 20-30 pounds have been raised to 200 pounds, and even higher limits appear in the offing.



The electronically controlled automatic furnace exhibited at the Royal Society Conversazione last month by the General Electric Company, for the production of synthetic sapphire, ruby, and rutile crystals. Fine alumina powder is dropped through an oxy-hydrogen flame and a fine rain of molten globules falls on the white-hot tip of the rod which grows upwards in a single crystal. As it grows, it is automatically withdrawn downwards by means of a photo-cell mechanism seen on the right

Laboratory Control in a Brewery

Ensuring Purity & Uniformity of Products

NAMES of four distinguished chemists, who served the brewery for an aggregate period of 106 years, are commemorated on a plaque in the new laboratory block of Ind Coope & Allsopp, Ltd., Burton-on-Trent.

The original laboratory was established in 1845, the first chemist being Dr. Henry Böttinger, a German, who was engaged by Samuel Allsopp on the recommendation of Professor Hofmann. Allsopp's thus became the first brewery in Britain, and possibly in the world, to introduce scientific methods of control. Böttinger's laboratory was a small, dark room with only one window. There are no records of the instruments and apparatus with which it was equipped, because at that period there was little scientific knowledge of brewing which was regarded almost entirely as an art.

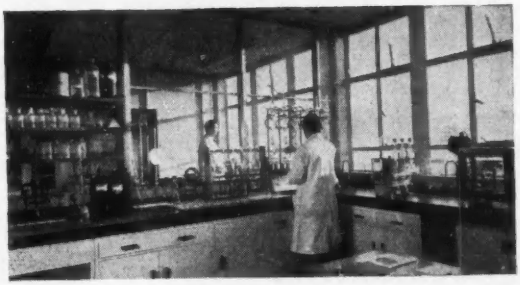
When a larger brewery was built during the 1850's a site was reserved for a new laboratory, which was a great improvement on its predecessor. The equipment included a number of instruments appropriate to the work being done as a result of the advance of scientific knowledge. A few of these instruments are still extant.

It was to this second laboratory that Böttinger's assistant, Dr. Peter Griess, was appointed in 1862. This scientist became famous as a result of his research into explosives and dyestuffs, but did little work on the science of brewing.

The appointment of Dr. Harrow coincided with the dawn of a new era in brewing. The chemists employed by various breweries in Burton formed a laboratory club, the members of which met at each other's houses for discussions on current topics. No doubt these talks often resulted in a new approach to the problems confronting brewers and to a better understanding of the requirements of control.

In 1909 Harrow was succeeded by H. E. Dryden, a pupil of Lawrence Briant who was considered to be one of the leading consultants on brewing problems. Dryden was destined to set up what will probably be an all-time record by being head of his department for 41 years, and it was during his term of office that merging of the Allsopp's and Ind Coope breweries took place. The Allsopp's laboratory was taken over as the forwarding office for the combined undertaking, both laboratories being concentrated into that of the Ind Coope, which was situated outside the brewery in a large room in the block of buildings of B. Grant & Co., a subsidiary company of Ind Coope & Allsopp. This reorganisation, which took place in 1935, was intended as a purely temporary expedient pending the construction of a new laboratory, but owing to the war the arrangement had to remain in force for a much longer period than had been anticipated. By the end of the war it had become obvious that the existing laboratory was totally unsuitable for work of the quantity and quality expected from it. New premises had therefore to be found.

A site which appeared to be convenient was available above a cold room housed in a building which had been erected just inside the main gate of the brewery. When the cold room was originally built provision was made for a second storey by extending the



The hop analysis laboratory at the Burton-on-Trent laboratories of Ind Coope & Allsopp, Ltd.

General view of malt analysis laboratory, looking through the partition to the beer analysis room

steelwork and covering it with a corrugated asbestos roof. It had been intended to use this room for a small bottle store, but it proved to be quite unsuitable for this purpose and therefore remained unused for many years, except as an occasional furniture store.

The laboratory had thus to be designed to fit in with the existing structure, its dimensions being limited by the size of the building. Plans were prepared by Mr. Neville Thompson, technical director of Ind Coope & Allsopp, in conjunction with the chief chemist, Mr. T. S. Bremner. Mr. Thompson had previously visited the laboratories at the Carlsberg and Tubourg breweries in Copenhagen, both of which had been most helpful with advice.

The premises comprise a series of small laboratories grouped round a general laboratory in the centre. In each of the small laboratories are to be found all the instruments, apparatus, chemicals, reagents, and so on, which are required for some specific work, so that if any particular determination is called for the assistant chemist uses the laboratory which is equipped for that purpose. The accommodation includes a thermostatically controlled cold room with two compartments which is fully insulated with cork throughout, the temperatures being adjustable from below zero to room temperature. There is also a staff room, a chief chemist's office, and a general laboratory office.

The standard bench units are located mainly along the outside walls beneath the continuous windows and are provided with flush fittings for all fixed and portable electrical apparatus at convenient points. All bench units are interchangeable and can be reassembled without skilled labour.

All radiators heating the laboratories are provided with towel rails, so that members of the staff need not carry damp towels on their shoulders or place them on top of radiators to dry.

An accent on brightness is emphasised in the colour scheme, for which old ivory was chosen, set off by a warm medium oak coloured floor. The central laboratory is lit by borrowed clere storey lighting and reflected light from the continuous windows in the outside laboratories. Artificial illumination is provided by continuous fluorescent lighting, which is so arranged that there is shadowless lighting on all the benches.

These laboratories with their up-to-date equipment are designed to assist the brewer by providing him with as much information as possible about the materials he uses, his plant and processes, and the products he supplies. There is a total staff of 15, whose responsibility it is to ensure the purity and uniformity of the various brands of beer. This involves mainly hop analysis, sugar analysis, water analysis, malt analysis, fuel analysis, determination of trace materials, biological work, analysis of beers, etc.

Perhaps the two most important factors in the production of characteristic beer are the water supply and the strain of yeast. Burton is located on the Triassic Keuper Marl which is rich in gypsum, and it is this mineral which gives Burton well water its special value for making pale ale. The main advantage of the gypsum is that when the malt is mashed the calcium precipitates certain buffering substances which keep the *p*H high. The effect is, therefore, to reduce the *p*H of the wort, thus creating more favourable conditions for enzymic action, particularly proteolytic enzymes producing a wort with a higher soluble nitrogen content,

which improves the growth of the yeast.

Reduction of the buffering effect is also advantageous, since the natural acid produced in the fermentation brings the *p*H down more quickly and that of the finished beer is therefore lower. This is an important consideration, since a beer with a *p*H figure in the region of four is more resistant to infection.

The optimum amount of gypsum is 55 to 77 parts per hundred thousand for pale ales and about 30 parts per hundred thousand for mild ales. All the large breweries at Burton have a number of wells and brew only from their own well water. In this laboratory control routine is mainly by conductivity measurements, but chemical analyses are undertaken periodically. Burton water is very constant, however, as analyses carried out nearly 70 years ago on water from Allsopp's wells gave results which differ very little from those obtained from some of the wells in use to-day. Magnesium in the water is regarded by some authorities as a valuable yeast nutrient, but others believe that the yeast obtains sufficient magnesium from the malt. Alkalis are undesirable, while carbonates are harmful because they are alkaline and so tend to raise the *p*H.

Examination of Yeast

One of the most important responsibilities of a brewery laboratory is the examination of the yeast. The yeast maintained by Ind Coope & Allsopp at Burton has been in use for as long as the oldest employee can remember, and probably for more than 75 years. The chief chemist has a photomicrograph of this yeast, which was taken as long ago as 1885. Comparison with the cell structure of the yeast in current use shows that no apparent change has taken place. This is ascribed to the close co-operation which has existed for many years between the laboratory and the brewery. Since the time of Dr. Griess the yeast has always been examined microscopically before use to ensure that the strain remains clean and healthy.

In the old days of brewing the easterly winds were believed to have an unfavourable influence on beer and brewers endeavoured to exclude them as far as possible. Probably this theory arose because these winds carried micro-organisms which affected the character of the beer. Unless wild yeasts and other organisms are kept under control they will appear in the pitching yeast and reproduce along with it, so that in quite a short time the pitching yeast becomes so badly affected that it can no longer be used.

A simple microscopic examination is sufficient to determine whether a yeast is clean or not. Even if a strain appears to be quite clean and healthy, however, it sometimes loses its power of reproduction and attenuation. If a yeast is suspect its attenuative power can be determined by laboratory tests.

Top fermentation yeast in most British breweries is not a 'pure yeast', because the pitching yeast usually consists of more than one strain. In the British system of brewing this is not a disadvantage, and for many years the yeast used at Ind Coope & Allsopp's breweries has performed its work efficiently and satisfactorily. Lager is fermented with an entirely different yeast, and for this purpose the company use only a pure strain, which has been developed from a single cell of a yeast shown to be satisfactory. Such a yeast is less resistant to infection than the top fermentation yeast and generally shows signs of weakening in a comparatively short time, so that the strain has periodically to be renewed. This can be done in quite a simple manner if a sample of the parent yeast is kept available, since it can be produced in sufficient quantity for the brewer's requirements within a matter of days, so long as the proper conditions for growth are provided. It has been estimated

Nitrogen determination room

that a handful of yeast, if grown under ideal conditions, could increase in a fortnight to somewhere in the region of 200 tons.

To obtain the best beer it is essential to have sound materials, a clean, vigorous yeast, and use a water that is known to be suitable for the particular quality. It is the function of the laboratory to ensure that all the materials used are closely controlled. Beer is classified as a type of foodstuff. As such it comes under the Food and Drugs Act, which specifies limits for various impurities which are always present, even in the best of brewing materials. These regulations are very rigid, and even if it can be demonstrated that the beer itself is well within the permitted limits, the authorities are not satisfied unless each of the constituent materials also conforms with the requirements of the Act.

Unless a very high standard of hygiene is maintained throughout the premises the brewery may become infected with organisms which cause beer spoilage. Great care must therefore be taken to minimise the risk of contamination by ensuring that conditions leave nothing to be desired. Bacteriological examinations of samples are carried out regularly and a particularly close watch is kept on all danger points.

The laboratories at Burton are the central laboratories of the Ind Coope & Allsopp group. They are equipped to deal with practically any problem which might arise in the brewery and its ancillary departments. Samples are also received for examination from England, Scotland, Wales, Ireland, Malta, and as far afield as Kenya and Uganda. Besides dealing with beers, the laboratories have been called upon to solve problems associated with wines, spirits and mineral waters.

Larger Nickel Allocations

The manganese-nickel-cobalt committee of the International Materials Conference has announced that an additional 220.7 metric tons of primary nickel is available for distribution to member countries in the second quarter of this year. It has become available, the committee explained, because of the unexpected increase in Norwegian nickel production this quarter.

Superphosphate Makers

International Gathering in Cannes

SOME 270 representatives from 20 different countries attended the annual series of meetings of the International Superphosphate Manufacturers' Association held recently in Cannes.

Besides the business meetings delegates were entertained at a cocktail party by the French superphosphate manufacturers and also at a banquet by the French North African phosphate producers, honorary members of the association, who also organised excursions to places of interest on the French riviera.

Delegation to Algiers

Following the meetings in Cannes, a small delegation of about 50 members proceeded to Algeria by special plane at the invitation of the Cie. des Phosphates de Constantine, visiting Constantine, the mines and installations at Kouif, and the phosphate loading plant at Bona.

Mr. R. Audouin, vice-president of the association and chairman of the agricultural committee since 1946, is shortly retiring from active business, and did not offer himself for re-election. At the general meeting, thanks were tendered to Mr. Audouin for his considerable services to the association in a voluntary capacity.

The secretary, Mr. R. M. Collins, who has also held office since 1946, having taken up an important commercial post, did not offer himself for re-election. An inscribed salver was presented to Mr. Collins in appreciation of his services.

For the year 1952/53, the following officers were elected or re-elected: *President*. R. Standaert (Belgium); *vice-presidents*: D. J. Bird (United Kingdom); A. Bloembergen (Holland); J. Capelo Portabella (Spain); B. Colbjörnsen (Sweden); H. Stevenius-Nielsen (Denmark).

Dr. G. F. New was appointed temporary acting secretary.

The Swedish members have invited the association to hold its 1953 Series of Annual Meetings in Stockholm. These meetings will take place during the week commencing 8 June, 1953.

A series of technical meetings will also be held in the autumn of 1953 in the United Kingdom, at the invitation of the British members.

Fluorescent Ink for Crack Detection

Simple & Rapid Method Demonstrated at Manchester

IN recent years the economic necessity for increased production and the introduction of mass-production methods, together with the widening application of welding processes, have resulted in a need for new and simple methods of non-destructive flaw detection.

Two recent inspection methods were shown to members of the technical Press at a demonstration given by the Manchester Oil Refinery, Ltd., at Trafford Park, on 26 May.

The latest means of revealing fine cracks or flaws invisible to the naked eye is 'Glo-mor' fluorescent ink which has been developed by the physics department of the Manchester Oil Refinery under the direction of Dr. R. Schnurmann and was demonstrated jointly with Hanovia, Ltd., manufacturers of the ultra-violet lamp equipment.

Designed as a tool for use with light metals, non-ferrous alloys, stainless steels and plastics, the process depends for its action upon the deposition in surface cracks of a material which fluoresces when irradiated with ultra-violet light. The method of application of the 'ink' is extremely simple and rapid compared with the X-ray and supersonic means of non-destructive detection which require expensive and delicate apparatus and highly skilled personnel.

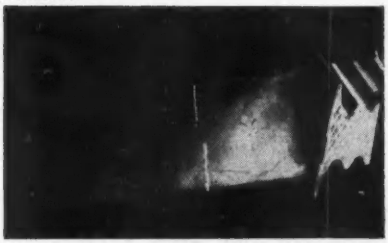
Alternative Method

The sample for examination can either be dipped into 'Glo-mor' fluorescent ink, which is a true solution and does not require any agitation, or alternatively a little ink may be poured over the surface. After allowing approximately one minute for the surface to become dry, the impregnated test piece is inspected under an ultra-violet light source.

Surface cracks reveal themselves by their brilliant green fluorescence, which can be seen even on a background of redundant green fluorescent material. These cracks are sufficiently clearly defined not to be confused with tide marks of the fluorescent ink. However, to remove the fluorescent background the test piece can be dipped very quickly into carbon tetrachloride, when the redundant background will be removed without dissolving the fluorescent material from the cracks. Again allowing about one minute for the surface of the test piece to become dry, inspection under an ultra-violet light source shows clearly the defined pattern of the surface cracks.

For the success of this method it is essential that the surface cracks should not be made up with oil or grease. If used engine parts are submitted for inspection it is desirable to degrease them first in either carbon tetrachloride or trichlorethylene.

In case some prospective users might raise objections to the application of carbon tetrachloride in their workshops for removing the redundant fluorescent material, this carbon tetrachloride wash can be substituted by an aqueous solution of a detergent, in which case a slight wiping action is required to remove the redundant fluorescing material.



An anodised turbine blade showing a surface crack made visible by the deposition of the fluorescent material in it

If the test piece is large, the 'ink' may be applied with a brush over the suspected part of the surface. Inspection can be carried out *in situ*. As a test for porosity the 'ink' is applied on one side of the object under examination and the inspection is then carried out on the opposite side. The same applies to welded plates or other welded structures which may have shrinkage cracks.

Typical applications include aluminium and magnesium alloys which form structural members of aircraft or of internal combustion engines, turbine blades and so on. Plastic materials, particularly plastic insulators, can be easily and quickly examined

and the flatness of surfaces can be tested by applying the fluorescent ink to the surface and moving a straight edge across it.

Further applications include inspection of alloy pistons, stainless steel parts and detection of cracks and holes in hydraulic systems.

An important feature of the 'ink' is that it is definitely not toxic.

Designed primarily for industrial applications, the Hanovia technical fluorescence lamp (model 15) used in the demonstration gives positive and immediate detection. Weighing only 2 lb., and manipulated like a hand-torch, the burner throws a powerful beam without dispersion, which even in semi-daylight gives brilliant fluorescence effects at distances up to several feet. It can be run for long periods without overheating and stands up to rough handling in everyday use. It is not necessary to wear goggles when using this lamp.

Increasing Applications

Some of the increasing applications of fluorescence techniques were briefly outlined by Mr. Ogden, northern manager of Hanovia, Ltd. These included: checking rates of flow through pipe-lines; time-study checking; in the textile industry machine oil is apt to find its way on to fabrics during spinning and weaving operations, and fluorescence tests are in general routine use throughout the industry for detecting the contaminant before further material is spoilt; in medicine as an aid to dermatological diagnosis; in chromatographic analysis; and in mercury vapour detection (*c.f.* THE CHEMICAL AGE, **66**, 149).

The other method demonstrated was the magnetic detection of superficial and subcutaneous flaws by means of a simple electromagnet, or a permanent magnet or a direct current-bearing coil of wire, and the application of 'Supramor' electro-magnetic flaw detection ink developed by the Manchester Oil Refinery, Ltd. The ink, supplied in black, red, yellow and white colours, is now widely used in industry.

A number of grades are available which vary according to the content of magnetic powder. The ink is suitable for any form of application. It can be poured on to the surface of the test-piece from a non-magnetic ladle; it can be sprayed; or the sample may be dipped in a bath of 'ink'. Black 'ink' gives good contrast on bright machined surfaces, while the other colours plainly show up cracks and internal flaws on the surfaces of black castings and other dark backgrounds.

The party was received by Mr. E. J. Dunstan, M.Sc., M.I.Chem.E. F. Inst.P., director, Manchester Oil Refinery, Ltd.; Dr. R. Schnurmann, of the physics department, and Mr. A. Peake, public relations officer.

Chemist's Bequests

PROFESSOR N. V. SIDGWICK, who died on 15 March (THE CHEMICAL AGE, **66**, 432), made a number of bequests to Oxford University.

The copyright and royalties relating to his book on 'The Electronic Theory of Valency', he left to Leslie E. Sutton, Fellow of Magdalen College, Oxford, expressing the wish, but creating no trust in the matter, that he will produce a new edition of the book.

Such of his scientific books as they may wish to have (including periodicals), Professor Sidgwick left to Chancellor, Masters and Scholars of the University of Oxford as an addition to the libraries of the Physical and Inorganic Laboratories of the university. To Lincoln College, Oxford, he left all manuscripts, writings, copyright and royalties relating to his book on 'The Chemical Elements', and such remainder of his books as they may wish to have.

Among Professor Sidgwick's financial bequests was a gift to the Telluride Association, of West Avenue, Ithaca, New York, with the request that it be devoted to 'the maintenance of their House at Cornell and of their College at Deep Springs, California'.

Professor Sidgwick left £67,025 (net £66,629). Duty paid £26,669.

International Co-operation

A lasting result of the successful chemical engineering exhibition (Achema X) held in Frankfurt last month, was the decision to make permanent the board of representatives of 17 countries which was established in connection with the exhibition. A working committee has therefore been formed to further international co-operation, the members being Dr. Herbert Bretschneider (Germany) M. Jean Gérard (France), Dr. F. A. Freeth (Great Britain), and Signor Luigi Morandi (Italy).

German Chemical Plant Exhibition

ACHEMA X Reveals Germany's Favourable Supply Position

THE previous exhibition of the German Chemical Engineering Society (DECHEMA) held in 1950 was an outstanding event in the field of chemical engineering, representing as it did the accumulated developments of Germany industry since the last pre-war exhibition in 1937. The ACHEMA X, which took place in Frankfurt/Main between 18-25 May this year was larger than ever before, but there were naturally fewer striking new developments in the two years that have elapsed since the previous ACHEMA IX.

The Exhibition was again arranged in eight large halls in the special exhibition grounds in Frankfurt, exhibits being grouped as follows: dosage and packaging machinery and laboratory apparatus; measurement and control equipment; research and technical literature; raw materials and materials of construction; complete plants and unit processes.

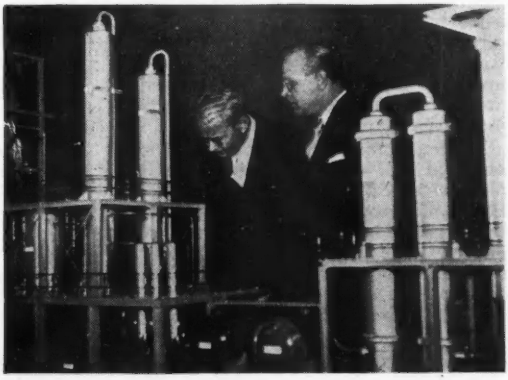
The French Société de Chimie Industrielle held its XXV International Congress concurrently with meetings of the DECHEMA and various other European scientific societies, and lectures were given on a variety of technological subjects.

The outstanding feature of the exhibition was the profusion of massive fabricated plant and forgings in special alloy steels and in stainless-clad mild steel of which the German industry appears to enjoy much more favourable supply than this country. Consequently German firms are still in a strong competitive position in world markets by virtue of the quick delivery they can offer on most types of plant. It is admitted however that competition is becoming keener on all sides.

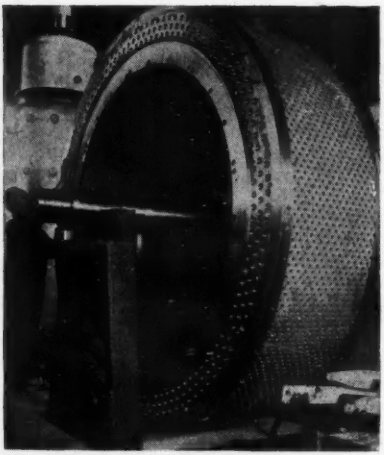
Another noticeable feature was the large number of companies offering ceramics, stoneware and acid-resisting brick construction, as well as special cements and surface coatings for corrosion protection. One new item in this field shown by Farbwerke Hoechst was a grade of 'Asplit' cement known as 'SWK', based on potassium silicate, which is resistant to mechanical and thermal shock such as that of crystallisation of salts.

Large items of fabricated plant included a cellulose kettle some 40 ft. high and 15 ft. diameter constructed in stainless clad steel (Carl Canzler, Duren) and a centrifuge basket over 8 ft. in diameter in stainless steel (18/8) (Essener Apparatebau).

Special metal powders for powder metallurgy and catalytic and chemical uses were shown by Eckhart-Werke and by Maschinenfabrik Meer AG. Among various precious metals applied in the chemical industry, new development was represented by a silver alloy, 'Optasil', with a brinell hardness of approximately 80/100 kg./mm², exhibited by Degussa, of Hanau. Combinations of silver with steel for various types of equipment were further developed, so was the range of the new rare metal catalysts. Seamless



Mr. Franz Bluecher, former German ERP minister and vice-chancellor, inspecting Fischer-Tropsch exhibits with Mr. Zinn, the prime minister of Land Hesse



Centrifuge basket over 8 ft. in diameter

tubes and other components in pure tantalum were shown by W. C. Heraeus GmbH. The same company demonstrated their equipment for the deposition of metals under high vacuum, showing samples of decorative items of metal-coated plastics of very high finish. A more recent development in this technique is the application of very thin films of noble metals on to chemical vessels, and it is claimed that vessels up to 2 metres in diameter can be treated in this way. Small samples were exhibited of indium, gold and titanium deposited on steel; gold on copper and on aluminium; and indium on lead. The samples were immersed in concentrated acids, including aqua regia, to demonstrate their high chemical resistance. This equipment is expensive, as also presumably is the process, but may well be suitable for special applications involving protection by high-priced metals such as those mentioned.

Plastics, and in particular rigid PVC, were exhibited in a variety of applications, one outstanding exhibit being of a complete bubble-plate some 6 ft. in diameter, fabricated entirely in PVC by welding and pressing. A great variety of smaller items of chemical equipment, such as jugs, buckets, trays, bottles, valves, etc., fabricated in PVC and other plastics, was also to be seen.

A new plastic material known as 'Hostaflon' was exhibited by Farbwerke Hoechst. This material is poly-trifluorochloroethylene, and corresponds to the American product 'Kel-F.' It has high chemical and thermal resistance, and although its properties are not equal to those of the fully fluorinated analogue known in this country as 'Fluon', 'Hostaflon' has the advantage of easier manipulation, being a true thermo-plastic which can be formed at temperatures between 240° and 280°C. The material is being used for diaphragms for manometers for use with corrosive fluids, and a sample was shown which had been in contact with moist chlorine gas at 70°C. for more than eleven months without deterioration.

Some interesting control devices developed in their own works were exhibited by Farbenfabriken Bayer, of Leverkusen. These included three types of depth gauge operated by capacitative, inductive and magnetic means, respectively.

Numerous paints and lacquers for corrosion protection were shown, including one on a chlorinated rubber base claimed to be resistant to sodium chlorite solution at elevated temperatures.

An interesting design of plant for continuous production of synthetic resins was shown by Samesreuther & Co. This consisted of a series of unit vessels each divided into compartments maintained under identical conditions of temperature and pressure. In operation, the individual compartments of each vessel are charged consecutively with the reactants and withdrawn similarly when reaction is complete. This arrangement thus has the effect of converting a batch process into a semi-continuous one and is claimed to facilitate close control of the conditions at all stages.

Wet Gas Catalysis System

Included in the wide range of plants produced by Chemiebau Dr. A. Zieren (formerly Chemiebau Dr. H. Schütt & Co.) is a wet gas catalysis system for manufacture of sulphuric acid from wet H_2S-containing gases. By combining this process with a modified version of the Orkla process it is possible to produce pure sulphur from pyrites and to convert the wet SO_2 effluent into 80 per cent sulphuric acid. It is understood that plant of this type has already been installed by the Albatros Works of Holland and that a plant is also under construction in England for conversion of coke oven gas.

Fuel Cell Patented

Producer Gas & Iron Oxide Used in U.S.

A NEW patented process in America is claimed to convert producer gas directly to electrical energy—by means of a 'fuel cell', and without preliminary production of steam, it was reported in *Petroleum Processing* recently. The process (U.S. Patent No. 2,581,650) as developed by Pittsburgh Consolidation Coal Company, has the claimed overall efficiency of 55-60 per cent. It is said to produce 0.5 to 0.9 volts per individual cell in a conversion unit which contains a series of such cells. Within the conversion unit, a high-melting glass solid electrolyte (sodium silicate, monazite sand, tungsten trioxide, and sodium carbonate) separates an anode chamber (iron-magnetite) from a cathode chamber (iron-iron oxide). The electrical conversion in the unit proceeds briefly as follows:

(1) Air is fed into the anode chamber at high temperature. At the same time, producer gas is fed through the cathode chamber. (2) Oxygen from the air reacts with the iron to maintain a state of oxidation. The iron oxide at the anode picks up electrons, so that oxide ions are released into the solid electrolyte. At the cathode, oxide ions are discharged to release electrons and oxidise the electrode to a still higher oxide of iron. (3) As producer gas circulates in the cathode, it combines with the higher oxide, so that the carbon monoxide in the producer gas changes to carbon dioxide; the hydrogen oxidises to water; and the higher oxide is reduced.

It is claimed that the energy produced by this reaction generates electricity in the conversion unit. The system appears to be adaptable to liquid hydrocarbons as well as to coal.

p-Nitrobenzoic Acid

IT IS announced that A.B. Bofors Nobelkrut, of Bofors, Sweden, have recently put into production an entirely new plant for *p*-nitrobenzoic acid, which is capable of meeting the entire European requirements of this product. The acid is produced by a new and unique method, which has been developed by the company's research department. This method is said to have proved very much superior to older methods. Patents have been granted, or are pending, in all important countries throughout the world.

p-Nitrobenzoic acid is an important intermediate for dyestuffs, local anaesthetics, procaine penicillin and in the antibiotic field.

Bofors Nobelkrut's agents in England are Guest Industrials, Ltd., 81 Gracechurch Street, London, E.C.3.

Basic Slag Prices

THE Ministry of Materials announces that the levy which has been charged on home-produced basic slag to meet the higher cost of imported material was withdrawn on 8 June, 1952. At the same time permitted maximum prices of home produced material were adjusted.

Prices of the higher grades of home produced slag (11 per cent to 17 per cent P_2O_5) were reduced by amounts varying from 3s. to £1 16s. 6d. a ton; increases of 6d. to 5s. 6d. a ton were made in present prices of the lower grades (10 per cent down to 6 per cent). Slag containing more than 17 per cent P_2O_5 ceased to be price controlled.

About two-thirds of the total production of basic slag is in the higher grades, the prices of which are being reduced.

It is the Ministry's intention that except for any alterations which may have to be made on account of changes in carriage costs the new prices should remain stable for the fertiliser season 1952-53.

German Patent Specifications

GERMAN Patent Specifications, delivery of which was suspended at the outbreak of war in 1939, are again being obtained at the Library of Commerce and Technology, Leeds.

The first consignment, Nos. 800,001 to 815,938, has arrived and are available for consultation. Further consignments are expected in due course. The gap, 678,144 to 800,000 of the war and subsequent years, cannot be bridged, but under an arrangement with the London Patent Office, photostat copies of individual patents can be obtained when required, at no cost.

In order to aid research it has been the practice to lend patents to libraries and industrial organisations operating outside this city on written request, and this service will be continued.

Analytical Congress

September Meeting at Oxford

FURTHER details have now been announced for the International Congress on Analytical Chemistry which will be held under the patronage of the International Union of Pure and Applied Chemistry at Oxford from 4-9 September, 1952. The president of the congress will be Sir Robert Robinson, O.M., D.Sc., F.R.S., and Sir Wallace Akers, C.B.E., F.R.I.C., F.R.S., will be vice-president.

IUPAC Board Meeting

Meetings of the Board of Section V, the Analytical Chemistry Section of IUPAC will be held on 3 and 10 September, and also of the following Commissions of the Section:— Physico-chemical data; analytical reactions; microtechniques; terminology and expression of analytical results. In addition there will be a meeting of the Commission for the Study of Fats, of Section VI, the Applied Chemistry Section.

The three main Congress lectures will be: 'Research in Analytical Instrumentation,' by Dr. R. H. Müller (Los Alamos Scientific Laboratory, New Mexico); 'The Value and Economic Importance of Chemical Analysis in Industry and Manufacture,' by Dr. L. H. Lampitt (chief chemist and director, J. Lyons & Co., Ltd., England); 'A Contemporary Assessment of the Place of Classical Methods in Chemical Analysis,' by Professor C. J. Van Nieuwenburg (Professor of Chemistry, Technical University of Delft. Holland).

Nine scientific sessions have been arranged as follows: Microchemical analysis; biological; electrical methods; optical methods; radiochemical;; organic complexes; reporting of results; adsorption and partition methods; and general.

Papers will be in English, but each one will include a summary in French and German.

Exhibition in Laboratory

Through the co-operation of industrial, Government, DSIR and university laboratories, a large collection of interesting and representative exhibits has been arranged and will be demonstrated in the Dyson Perrins Laboratory. These will illustrate new techniques or special applications of older techniques in analytical chemistry.

Telcon's Plastics Division

THE company which pioneered the development of gutta percha, The Telegraph Construction & Maintenance Co., Ltd., of Telcon Works, Greenwich, has announced the formation of a plastics division. Telcon manufactures cables, metals and thermoplastic products, and has for many years been supplying gutta percha in a variety of extruded, moulded and fabricated forms, as well as purified gutta percha specially prepared for golf ball manufacture.

With the discovery of polyethylene in 1933, Telcon quickly applied its long experience in handling thermoplastics to the commercial exploitation of this material, and began to produce Telcothene powder and a wide range of moulded and fabricated articles based on polyethylene.

The new division, which will be under the managership of Mr. H. F. Wilson, B.Sc., A.R.I.C., A.I.R.I., formerly technical manager of Telcon, has been created to handle the production and marketing of all the firm's thermoplastic products outside the field of cables.

British Standards Year Book

A COMPLETE list of the 1,800 British Standards current at 31 March, 1952, with a brief description of the subject matter of each, is contained in the 1952 edition of 'The British Standards Year Book', just published. Easy reference is aided by a subject index.

Particulars are also given of the membership of the General Council of the British Standards Institution and of its Divisional Councils and Industry Standards Committees. The Industry Standards Committees, of which there are 59, each represent a major British industry. Through them the work of drafting British Standards is delegated to some 2,200 technical committees and sub-committees.

In addition 20 special committees, some of an advisory category, are listed.

This useful reference work may be obtained from the British Standards Institution, 24 Victoria Street, Westminster, London, S.W.1, price 7s. 6d.

The Italian Abrasive Industry

A Review of a Little-Known Industry

THERE is one industry in Italy of which one seldom hears, and that is the production of grinding stones and abrasives of various types. This is not surprising as this branch of industry has no spectacular machinery or colossal output to show to a casual observer. At the same time, it is difficult to imagine a branch of mechanical industry in which one sort or another of abrasive is not indispensable.

In Italy this industry is comparatively new, as before the war most of the abrasive materials required were imported. Under the stress of events, however, it has developed, and a number of specialised factories with up-to-date equipment have materialised. At present, there are some twenty factories in Italy with about 1,500 workmen engaged in this field. Their total potential yearly output amounts to:—

Grinding stones and agglomerates, 7,500 tons.

Granular abrasives, 3,500 tons.

Flexible (paper and cloth) abrasives, 12,000,000 square metres.

During 1951 this industry produced the following materials:—

Grinding stones and agglomerates, 5,000 tons (66 per cent of total capacity).

Grinding abrasives, 2,500 tons (71 per cent of total capacity).

Abrasive paper and cloth, 8,500,000 square metres (71 per cent of total capacity).

Importation Difficulty

One of the difficulties of this industry in Italy is that artificial emery, silicocarbide and Manilla paper have to be imported. Apart from finding these products at remunerative prices, there is also the problem of pretty high import duty (20 per cent on Manilla paper, 18 per cent on emery, and 15 per cent on silicocarbide).

The producers have been pressing the Government to help them in this field. It has been suggested that 2,000 tons of artificial emery and 1,000 tons of silicocarbide should be admitted into the country every year, duty free. It seems that the Italian Ministry of Trade and Industry has found it impossible to accede to this request, but it is said that rebates in duty will be given during the current year for a total quantity not exceeding 1,000 tons of artificial emery and 500 tons of silicocarbide.

Side by side with this problem there has been an alarming (for Italian producers) increase in imports of finished abrasive products. In fact, during 1951 Italy imported about three times more abrasives than in 1938, as can be seen from the figures below (in tons):—

	1938	1948	1949	1950	1951 (approx. figures)
Abrasive paper and cloth	211	134	323	486	750
	350	223	579	543	850
Total	561	357	902	1029	1600

The total value of abrasives imported by Italy in 1951 is reckoned roughly at 1,000,000,000 lire. Considering that Italian manufacturers produced during the same year about 4,750,000,000 lire worth of abrasive products, the slice of the market captured by imports is not small.

Italian manufacturers have been doing their best to remedy this situation by exporting in their turn. Some success has been secured in this direction, but recently a disappointment was caused by a new commercial policy on the part of France. This country used to purchase nearly a quarter of all abrasives exported by Italy, but it appears now that it will stop these purchases altogether.

The only hope for Italian producers of abrasives lies, then, in the reduction of import duty on their materials, which would enable them to compete with better advantage against abrasives imported from other countries.

Three Scheelite Treatments

Results of six preliminary tests to establish satisfactory methods for treating scheelite (tungsten) ores and tailings for concentrator operations are described in a recent U.S. Bureau of Mines publication (Report of Investigations 4867). The tests involved three methods of treatment—gravity concentration, magnetic separation, and flotation, and procedures and tables on test results are included in the publication.

The Chemist's Bookshelf

VALENCE. By C. A. Coulson. London, Oxford University Press. 1952. Pp. 338. 25s.

Professor Coulson's book on valence will be welcomed alike by students and teachers of chemistry for it is the first book in the English language which has attempted to present an all-inclusive account of modern theories of the nature of the chemical bond. The competing theories which have now held the stage for close on twenty-five years—the method of molecular orbitals based on Schrodinger's wave equation and the valence bond treatment of Heitler and London—are shown to be approximations whose range of validity is now sufficiently well known to warrant the employment of both together in the solution of a single problem.

The book opens with a brief but lucid chapter which, by explaining the defects of the earlier theories of Lewis, Langmuir and Kossel, clears the way for the introduction of the concept of the atomic orbital and the wave-mechanical theory of the atom. There follows an invaluable account of the Schrodinger wave equation from which is developed in an easy and natural manner the molecular orbital method of dealing with polyatomic molecules. The reader is then introduced to the valence bond treatment of diatomic molecules and a careful comparison is made of the two competing theories when applied to a number of typical valence problems. The author's verdict, with which few will quarrel, is that in cases where both theories predict similar conclusions there is considerable ground for believing that these conclusions are correct. In other cases, where agreement is less satisfactory, only a very detailed examination will reveal which of the two approximations is valid. To chemists the last half of the book will probably be of most value. Stereochemistry, hyperconjugation, the hydrogen bond and the metallic bond are all discussed from the point of view of valence bond and molecular orbital theory.

This book emphasises that the chemical revolution which began with Niels Bohr's description of the first satisfactory dynamic model of an atom, is now virtually complete. Many refinements of the theories which Professor Coulson describes are obviously necessary and many, no doubt, will be forthcoming in the very near future. But the main road ahead seems clear. A future theory of valence which does not incorporate the broad ideas described in this book is, at any rate to the reviewer, inconceivable.

While mathematically trained chemists will profit most from this book it is in no sense a book for mathematicians. In spite of a disclaimer by the author it is essentially a textbook of chemistry and should be in the hands of every serious student of chemistry in or out of our Universities. This does not mean that every student of chemistry in or out of our universities. This molecular orbital calculations. But it does mean that he should be able to appreciate the inadequacy of any electronic theory of valence which is not couched in wave-mechanical terms.—R.C.P.

KURZES LEHRBUCH DER ANORGANISCHEN UND ALLGEMEINEN CHEMIE. By G. Jander and H. Spandau. Fifth edition. Berlin: Springer-Verlag, 1952. Pp. 563. D.M. 19.80.

This book provides a general survey of inorganic and general chemistry, ranging in scope from almost first principles to approximately pass degree standard. In such a book, while treatment of many topics must of necessity be brief, it is important that adequate treatment be given to the more important aspects with outlines of less fundamental topics. Mention of important recent topics is also desirable. While these requirements appear to be largely met there are a few instances where discussion of fundamental aspects is very brief and treatment of other topics perhaps a little

unbalanced. Some important recent developments are omitted.

The first third of the book introduces the subject by a study of hydrogen, oxygen, carbon, the halogens, sulphur, selenium, tellurium and their simpler compounds. The properties of metals and solutions, ionisation theory, simple electrochemistry, equivalents, thermochemistry and chemical equilibrium are also introduced.

The periodic system, atomic structure, isotopes and valency theory are then considered. The brevity of treatment is very obvious here, the Bohr theory receiving little more than a mention and less than a page being devoted to the separation of isotopes. Elements and their compounds are then treated systematically on the basis of the periodic classification. The section on the actinides is very brief, less than a page being given to thorium and uranium. Mention might have been made of the recent chromatographic separation of lanthanides. Though details of the separation of the platinum metals are too specialised for a book of this type the principles on which such methods are based might have been included.

The final third of the book is devoted to special topics including a useful section on physical methods used in inorganic investigations. Polarography, spectroscopy, electron microscopy and colorimetry are included. In view of the growing importance of chromatography in inorganic chemistry some mention of this might have been made. Similarly, the use of thermistors in the measurement of temperature might have been included. Other sections include catalysis, complex formation and co-ordination theory, intermetallic compounds and phases, hydrides and colloids. In the latter mention might have been made of the use of froth flotation in the separation of ores and of such rheological properties as thixotropy. Poly-acids and bases and high molecular weight inorganic compounds are discussed and a section on reactions in the solid state includes very brief outlines of cement and ceramics and a more detailed one of powder metallurgy. A useful account of reactions in liquid ammonia, liquid sulphur dioxide and molten mercuric bromide is given and a brief survey of geochemistry.

The comments regarding brevity and omissions are not made in too critical a sense. The topics referred to are generally physico-chemical in nature and the book does provide a wide general survey of inorganic and general chemistry. The brevity of treatment would, apart from the language difficulty, probably necessitate further reading by advanced students. Printing and binding are good and errors appear to be very few.—W. R. MOORE.

ELSEVIER'S ENCYCLOPAEDIA OF ORGANIC CHEMISTRY. Series III. Vol. 12B. Edited by F. Radt. Published by Elsevier Publishing Company, Amsterdam; distributed by Cleaver-Hume Press Ltd., London. 1952. Pp. 2717-3260. £14 to subscribers.

By this time it must surely be quite unnecessary for a reviewer to draw the attention of organic chemists to the existence and importance of Elsevier's Encyclopaedia of Organic Chemistry, for there can be few of them who have not had occasion already to consult the earlier volumes and to admire the way in which a wealth of information has been contained therein without resorting to small print and to the excessive use of abbreviations.

The three volumes (12-14) of Series III are devoted to carboisocyclic condensed compounds, and deal, respectively, with bicyclic, tricyclic and higher-cyclic compounds. Owing to the enormous number of substances which fall into the first group, it has been necessary to divide Volume 12 into two parts covering (A) all bicyclic compounds except those with the naphthalene skeleton, and (B) naphthalene and its derivatives. The volume under review is that section of Volume 12B which deals with naphthaquinones and polyketohydronaphthalenes. It provides a summary of relevant papers published before the end of 1944; the literature concerning the structures of the compounds has been consulted up to the beginning of 1952. The subject index and formula index are very comprehensive and should enable any desired compound to be located rapidly.

The real value of a book of this type cannot be assessed except by the light of experience in its use, since it is wholly dependent on the care with which the references have been collected and on the accuracy of the data presented. However, if the present volume reaches the high standard of earlier volumes there will be little room for criticism.—E.J.B.

HOME

Zinc Price Cut Again

A further decline in the price of American zinc was followed on 6 June by a reduction in the U.K. price by £12 to £138 a ton. This was the third reduction in the U.K. level in a fortnight, during which the price dropped from £190 a ton.

Oil Find in Lancashire

Oil has been found at Cronton Colliery, Widnes, during the recent geological survey of South Lancashire. Geological survey workers of the NCB were boring at 1,600 ft. when they struck oil instead of the expected coal samples. On examination the oil was found to be similar to that being tapped at Formby, and it is possible the same lake extends throughout this part of Lancashire. A survey of more than 400 sq. miles of Lancashire is being carried out by Steel Brothers, which has received licences from the Ministry of Fuel and Power to Prospect for oil.

Petrochemicals Strike Ends

Three hundred maintenance men who went on strike at Petrochemicals' works at Partington, near Irlam, Lancs., on 3 June, because 60 workmen had received redundancy notices, returned to work on the afternoon of the following day. Union officials addressed the strikers outside the works and the men agreed to end the strike on being told that the management would withdraw the dismissal notices.

Scientific Manpower

Criticism of the present and former Government for its policies on scientific manpower was made by the Institution of Professional Civil Servants in a statement issued recently on the recommendations made in the fifth annual report of the Advisory Council on Scientific Policy. It was pointed out by the institution that more attractive salaries are at present offered on the administrative than on the scientific side of the Civil Service and that any move to implement the Advisory Council's report must come primarily from the Government itself. Nothing in the last few years lends any hope of the warnings and proposals of the report being heeded, the general secretary stated.

Director Retires

Major F. H. Bramwell, a director and chief engineer of the General Chemicals Division of Imperial Chemical Industries, Ltd., retired on 31 May, after 32 years' association with the company. He was presented with a grandfather clock by the staff of the chief engineer's department, Runcorn.

Duty Exemptions

The following articles have been exempted from Key Industry Duty, for the period 11 June to 18 August, 1952:

2: 6-Di-*tert*-butyl-*p*-cresol (−OH = 1) (a butyl cresol).

Histamine dihydrochloride (a histamine salt).

(+) Methionine.

(−) Methionine.

mono-3-Methoxy-*n*-butyl acetate (a methoxybutyl ester).

o-Nitrobenzoic acid.

γ-Picoline.

m-2-Xylidine (an amino-xylene).

R. Xylose.

The Order is the Safeguarding of Industries (Exemption) (No. 4) Order, S.I. 1952, No. 1117 (price 2d. net, by post 3½d.). Copies may be obtained from H.M. Stationery Office.

Plastics Machinery Works Expansion

Extensions, which will be largely devoted to satisfying overseas orders, particularly those for extrusion machines for the U.S.A., were officially opened on 6 June by Mr. John Boyd-Carpenter, Financial Secretary to the Treasury, at the works of R. H. Windsor, Ltd., South Chessington, Surrey. The extensions included a new main shop, a double expanded mould and die shop, a drawing office which can accommodate 26 draughtsmen, a new executive office block and an enlargement of the canteen.

Ana'ysts' Summer Meeting

The Summer Meeting of the Biological Methods Group of the Society of Public Analysts and Other Analytical Chemists was held in Nottingham on 12 and 13 June, and consisted of a visit to Messrs. Boots Pure Drug Co., Ltd., scientific papers and demonstrations.

• OVERSEAS •

Scrap Metal Drive

The importance of metal scrap for essential civilian and defence uses in America has led to the formation of the Non-Ferrous Scrap Metal Mobilisation Council, with offices at 205 East 43rd Street, New York. Co-operating in every way in this drive are the U.S. Chambers of Commerce. As one significant example of the importance of non-ferrous scrap, it may be noted that as much copper is recovered annually from copper and copper-alloy scrap as is mined by the great copper companies in the United States.

Spain's First Polyvinyl Factory

A factory established at Hernani, Guipuzzcoa, is the first in Spain to manufacture polyvinyl chloride and is at present turning out one metric ton a day. The installation has been imported from Belgium and about 50 per cent of the capital is also Belgian. Three similar plants, it is reported are being set up in other parts of the country.

Greek Bauxite Agreement

An agreement has been made, with the approval of the Greek Government, between the Eleusis Bauxite Mines and the Mutual Security Agency Mission to Greece, whereby the latter will lend the company $1,450,000 in American, Greek and German currencies at 4 per cent interest. In return, the company will deliver, up to the end of 1954, 450,000 tons of bauxite ore mined at Eleusis. The bauxite will be shipped to Germany for processing into 100,000 tons of aluminium, part of which will go towards repayment of the loan. Bauxite deposits at Eleusis are estimated at 3,000,000 tons of proven ore reserves and 5,000,000 tons of probable reserves.

Australian Anti-Rust Process

A new proprietary anti-rusting composition, applicable with a brush, has been reported from Australia. The process is claimed to be the only one yet developed whereby a permanent coating of zinc can be applied to any iron or steel structure irrespective of size, either before, after, or during construction. Drying of the coating after application at 300-400°F. makes the coating insoluble in water.

Canadian Uranium Prospects

A claim that within the next five years Saskatchewan will be the world's largest producer of uranium is reported to have been made by its chief minerals official. Some £3,300,000 will be spent this year on exploration—twice as much as last year, he said, and £10,000,000 will be spent this year in oil exploration and development.

Japanese Plastic Plant

The first vinyl plastic plant to be built in Japan with American technical aid has started production at Kambara, near Tokio, it is reported. The plant, which will increase Japanese production of the plastic by approximately 50 per cent, is owned and operated by the Japanese Geon Co., Ltd. Engineering design and manufacturing techniques for the new plant, which has a capacity of 6,000,000 lb. a year, were contributed by the American firm, B. F. Goodrich Chemical Company. The production of the plant will be used to meet Japanese demand.

New Systemic Insecticide

A new systemic insecticide announced by the Pittsburgh Agricultural Company is derived mainly from nitrophenol and methyl umbelliferone, and is said to be effective in applications of as little as 1 oz. per acre. Called 'Systox', it is said to have been effective against a wide range of insects that attack citrus and other fruit trees, cabbage, cauliflower, potatoes and tobacco, as well as ornamental trees. The effect is said to last from one to two months. It is extremely toxic to animals and humans.

Straw-Pulp Factory set up in Greece

Erection of a straw-pulp factory by the Hellenic Cellulose Industry has begun at Larissa, in Central Greece. It is expected that 7,500 tons a year of paper pulp will be produced from wheat and rice straw. Production is scheduled to begin in about 18 months. The straw-pulp will be mixed with waste paper, rags and imported woodpulp and will be processed into 10,000 tons of finished paper a year. At present all paper manufactured in Greece is made from imported pulp. Paper consumption reached 50,000 tons in 1950.

· PERSONAL ·

At the annual general meeting of the Institute of Physics held on 5 June, DR. C. SYKES (managing director, Thos. Firth & John Brown, Ltd., Sheffield) was elected president.

MR. O. W. HUMPHREYS and DR. T. L. IBBS were elected vice-presidents and DR. S. WHITEHEAD was elected honorary treasurer. DR. B. P. DUDDING was re-elected honorary secretary. The four new ordinary members of the board elected were MR. H. BARRELLL, DR. N. A. DE BRUYNE, DR. W. H. TAYLOR and MR. R. G. WOOD.

SIR OWEN W. RICHARDSON, F.R.S., was elected to Honorary Fellowship, the highest honour which the Institute can bestow. Sir Owen was Professor of Physics at King's College, London, for many years and is known for his distinguished fundamental work on thermionics. In 1928 he was awarded the Nobel Prize for Physics.

PROFESSOR T. S. WHEELER, Professor of Chemistry at University College, Dublin, and a director of Chemicals, Ltd.; MR. J. W. PARKES, M.S.C., F.R.I.C., assistant managing director of W. and H. M. Goulding, Ltd., and a director of Drogheda Chemical Manure Co., Ltd.; and DR. G. VAN DER LEE, managing director of Chemicals, Ltd., have been elected to the Council of the Institute for Industrial Research and Standards in the Republic of Ireland.

MR. J. DAVIDSON PRATT, C.B.E., M.A., B.Sc., M.I.Chem.E., F.R.I.C., director and secretary of the Association of British Chemical Manufacturers, and M. JEAN GERARD, vice-president and founder of the Société de Chimie Industrielle, have been awarded honorary membership of Dechema (German Association for the Development of Chemical Apparatus) in recognition of their services for international co-operation in chemical engineering during the past 25 years. They are the first foreigners to be so honoured. Documents conferring the membership were presented by Dr. Hans Broche, chairman of Dechema, at the opening of the European Congress for Chemical Engineering held in Frankfurt last month in connection with Achema X.

MR. A. M. KNOX has been appointed a member of the board of Unilever, Ltd., and it is intended to propose to this year's annual general meeting of the shareholders of Unilever N.V. that he be appointed also as a member of the board of that company.

The Minister of Fuel and Power has appointed SIR HENRY TIZARD to be a part-time member of the North Thames Gas Board. Sir Henry was Permanent Secretary of the Department of Scientific and Industrial Research and, for several years, chief scientific adviser to the Government.

Officers for 1952-1953 elected at the annual meeting of the Chemists' Club, New York, include: President, WILLIAM F. GEORGE; Resident Vice-President, IRA VAN DEWATER; Non-Resident Vice-President, R. J. QUINN; Suburban Vice-President, F. W. SULLIVAN; Treasurer, L. E. ERLANDSON; Secretary, LLOYD VAN DOREN. Also elected as Trustees for the three-year term 1952-1955 are THOMAS B. DREW, S. H. FARKAS, FOSTER D. SNELL and LINCOLN T. WORK.

PAUL F. SWANSON has been appointed manager of the process engineering department of The M. W. Kellogg Company, international refinery and chemical engineering organisation. In his new position, Mr. Swanson will be in charge of his firm's large staff of process engineers, which is at present designing more than a score of major petroleum refining and chemical processing plants throughout the world.

Mr. Swanson was prominent in the development of the first continuous catalytic cracking process using the Fluid catalyst principle. Most recently, his experience has been applied to Kellogg's part in the development of Fluid Hydroforming—a new refining method which economically converts low octane gasolines into high quality gasoline blending stocks.

Included among the current Kellogg design projects with which Mr. Swanson will be associated, are the world's first Synthol plant, a Kellogg design for the production of gasoline and diesel fuel from coal, to be erected in South Africa, and the phenol-from-cumene plant in Canada.

Publications & Announcements

THE Quasi-Arc Company, Limited, of Bilston, Staffordshire, have produced a revised edition of their popular Instruction Book for Electric Arc Welders. This 68-page booklet describes the arc welding of mild steel in all positions and the text is well supplemented by numerous photographs and diagrams. Copies can be obtained on application to The Quasi-Arc Company's Head Office at Bilston, Staffordshire.

* * *

A SELECTION of recently developed equipment for use in the modern laboratory are shown in a new catalogue issued by Griffin and Tatlock Limited. Amongst the many specialities of which details are given are distillation columns, a Kinetic Elutriator, the Heywood photoelectric sedimentometer, gas analysis apparatus, the Microid Gas Generator, and apparatus for the continuous estimation of nitric acid in fuel gases. The catalogue, 16B-S, can be obtained from the company at Kemble Street, Kingsway, London, W.C.2, or any of its provincial offices.

* * *

CHEMISTRY'S growth during the present century has been one of the most significant factors in our modern civilisation, while the aptitude and fertility of mind which the chemist has manifested in satisfying the demands of a world striving to achieve an adequate economy, have been remarkable. These points were emphasised by Sir Ian Heilbron, D.S.O., D.Sc., LL.D., F.R.S., chairman of the Advisory Council for Scientific and Industrial Research, when he delivered the 25th Sir Jesse Boot Foundation Lecture on 14 March, 1952. The lecture, entitled 'The Rôle of Chemistry in the Solution of World Problems,' has now been printed in booklet form and is obtainable from the University of Nottingham (price 1s. 6d.).

* * *

MARCONI Instruments Limited have recently produced another booklet describing the applications of their range of electronic instruments in industry, telecommunications and medicine. This is *Marconi Instrumentation*, Volume 3, No. 5, and it contains articles on the construction of a vibrating capacitor unit, on electronics in X-ray control, and on the special products group of the company.

CO-OPERATION between the chemist and the engineer is exemplified by the continuous solvent oil extraction plant which has been manufactured and installed for the British Extracting Co., Ltd., at Bromborough, by Rose, Downs & Thompson, Ltd., of Hull. A special illustrated catalogue (List No. 48) has now been issued by Rosedowns describing the plant, which was designed to extract the oil from groundnut kernels by special methods which allow the protein in the residual meal to be used for the production of 'Ardil' fibre. (A detailed report and illustrations appeared in THE CHEMICAL AGE, 66, 409.)

* * *

SHARPLES' Bulletin 152 is now available. This describes the Sharples' laboratory super-centrifuge using a centrifugal force of up to 62,000 g. made by Sharples Centrifuges, Ltd., of Woodchester, Stroud, Glos.

* * *

THE proceedings of the 16th conference of the International Union of Pure and Applied Chemistry in New York and Washington from 8-15 September last year are now available in English and French from the British National Committee for Chemistry, Burlington House, Piccadilly, London.

* * *

A NEWLY issued booklet (No. 1710), 'Platinum Laboratory Apparatus', in conjunction with 'Platinum Electrodes' (No. 1720—already published), replaces three earlier publications of Johnson, Matthey & Co., Ltd. (Nos. 44, 45 and 47). It describes all the apparatus, other than electrodes, regularly supplied for chemical analysis, including micro-analysis, and the proper care and maintenance of apparatus.

Particulars are given of two ranges of crucibles. Shape 'UB' replaces the old 'A' and 'B' shapes; these crucibles are of the usual deep type. Shape 'UA' crucibles are an entirely new range of squat vessels designed particularly for furnace ignition. The range of sizes of dishes has been extended, and a number of special-purpose dishes are described. Pieces of apparatus no longer in demand have been removed from the list, and the method of numbering has been aligned with the standard code.

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

C. S. K. PLASTICS, LTD., Bury. (M., 7/6/52). 2 May, two mortgages, to District Bank Ltd., each securing all moneys due or to become due to the bank; respectively charged on land and building formerly used as an engine house part of Moorside New Mill, and plot of land at north or north-east side of Moorside New Mill, Bury. *Nil. 13 December, 1951.

HANOVIA, LTD., Cippenham, dealers in medical, technical and scientific lamps. (M., 7/6/52). 1 May, to Chase National Bank of the City of New York, securing all moneys due or to become due to the bank; general charge. *Nil. 29 November, 1951.

PHILBLACK, LTD., Bristol, carbon black manufacturers. (M., 14/6/52). 7 May, deed dated 18 April, 1952 (supplemental to Trust Deeds dated 5 May, 1949, and 23 November, 1950), securing £1,600,000 Secured 'A' Notes inclusive of £1,100,000 secured by said Trust Deeds, present issue £500,000; charged on specified properties at Bristol; and a general charge. *£1,250,000. 31 October, 1951.

E. & A. WEST, LTD., Derby, chemical manufacturers. (M., 7/6/52). 7 May, charge, to Westminster Bank Ltd., securing all moneys due or to become due to the bank; charged on works and premises at Parcel Terrace, Derby, with fixtures. *Nil. 2 June, 1951.

Increases of Capital

The following increases of capital have been announced: J. M. BECKETT & SON, LTD., from £10,000 to £40,000; POLYCHEMIA (LONDON), LTD., from £100 to £1,000; R. CRUICKSHANK, LTD., from £150,000 to £200,000.

New Registration

Alex Reed & Co. Ltd.

Private company. (508,198). Capital £2,000. Manufacturers of chemical products, disinfectants, fertilisers, dyes, colours, etc. Directors: B. Gilford and A. Reed. Reg. office: 36 Oxford Street, W.1.

Company News

The British Drug Houses, Ltd.

Several new products resulted from the research carried out by British Drug Houses, Ltd., during the year ended 31 December, 1951, and are now being successfully marketed. Substantial sums were again spent on research and plans are in hand to increase the facilities for biological evaluation of new substances. Since the end of the financial year a factory has been acquired at Godalming which should help to overcome the lack of suitable manufacturing space at the London sites. Consolidated trading sales of the company and its overseas subsidiaries reached a record total of £5,500,000—a large increase over the figures for 1950 which themselves represented a record. Of this total nearly 43 per cent was contributed by overseas markets. Net profits of the parent company amounted to £227,317, an increase of £74,078 over 1950. A dividend of 12½ per cent on ordinary stock is recommended. Annual general meeting will be held at Winchester House, Old Broad Street, London, E.C.2, on 26 June.

Coalite & Chemical Products, Ltd.

Substantial progress resulting from a steady development of manufacturing capacity and technique is reflected in the report of Coalite & Chemical Products, Ltd., for the year ended 31 March. Combined profits rose by nearly 55 per cent to £715,000. A final dividend of 5 per cent (3 per cent) with an unchanged interim dividend of 3 per cent, makes a total for 1951/52 of 8 per cent, compared with 6 per cent in the three previous years.

Dunlop Rubber Co., Ltd.

Available net profit of the Dunlop Group of Companies for 1951 amounted to £4,607,413, compared with £5,062,863 in the previous year. Aggregate sales of the group amounted to £284,000,000 compared with £197,000,000 in 1950. While higher price

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levels naturally had some bearing on the increased sales value, there was also a significant rise in the volume of goods sold. Export and overseas activities accounted for more than half of the group profits. The proposed dividends to all shareholders in the group amount to £1,812,916, or 39 per cent of the available net profit, leaving 61 per cent, amounting to £2,794,497, transferred reserves and surplus and retained in the group. The 53rd annual general meeting was held at the Piccadilly Hotel, London, on Monday, 9 June.

Howards & Sons, Ltd.

Further capital to complete its expansion programme is being raised by Howards & Sons, Ltd., 155-year-old manufacturers of fine, pharmaceutical and industrial chemicals. Growth of the original project is mainly due to development of the Canadian market. Most of the new money is being obtained from £350,000 five per cent First Mortgage debenture stock, 1972-1977. This is being subscribed at 97½ by the Charterhouse Finance Corporation, which is also taking up 97,000 ordinary £1 shares at par. Party of the equity of this business is thus released to the public for the first time. The group's net tangible assets will be increased by the two issues to £1,559,924.

Jenson & Nicholson, Ltd.

Group trading profits of Jenson & Nicholson, Ltd., for the year ended 31 December, 1951, rose from £468,000 to £541,000 despite the rising costs of raw materials and containers. As a result of the one-for-one scrip bonus and a subsequent rights issue last year, share capital now stands at £488,000. The 10 per cent paid on the old capital, and 10 per cent final on the enlarged capital compares with 20 per cent last year.

Shell Transport and Trading Co., Ltd.

Net revenue for the year ended 31 December, 1951, of the 'Shell' Transport and Trading Co., Ltd., increased from £6,438,477 to £7,399,129. An interim dividend of 1s. per unit, free of tax, was paid on 7 February, 1952. A final dividend of 1s. 6d. per £1 unit and a bonus of 6d. per £1 unit, both free of tax, are recommended to be paid on 9 July, 1952. Consent has been given by H.M. Treasury to the issue by the company of 10,902,939 ordinary shares by capitalising £10,902,939 of the Share Premiums Reserve. It is proposed that the new shares be allotted on the basis of one new share for each £4 of ordinary stock or four ordinary shares held. It is pointed out that the additional shares to be issued are not 'bonus' shares, that they will in no way affect the shareholders' interest in the total equity of the company, nor does the issue involve any greater distribution of profits than would have been possible without it. A survey of the activities of the group is presented in a separate illustrated brochure. Annual general meeting will be held at Winchester House, Old Broad Street, London, E.C.2, on 27 June.

Unilever, Ltd., and Unilever N.V.

No change is to be made in the dividends recommended by the directors of Unilever, Ltd., and Unilever N.V. in respect of the year 1951 payable on 4 July, 1952. Unilever, Ltd., announces a final dividend of 8½ per cent, making 13½ per cent for 1951. In the previous year there was only one payment (13½ per cent), the interim for 1951 being the first since before the war. The final dividend of Unilever, N.V. is 7½ per cent, making a total of 12 per cent for 1951. This was the same as the single payment in 1950. Combined trading profits of the English and Dutch partners in the Unilever enterprise rose in 1951 from £57,100,000 to £59,000,000. New ordinary capital raised last year does not rank for the proposed dividends. Annual general meetings will be held on 23 June.

Successor Named

The Colonial Office announces that DR. R. A. E. GALLEY, who has for the past year been seconded from the Agricultural Research Council to the secretariat of the Advisory Council on Scientific Policy, has been appointed Director of Colonial Products Research, with the rank of deputy chief scientific officer, in succession to SIR JOHN SIMONSEN, who is retiring. The appointment will take effect from 1 January, 1953.

Dr. Galley will also take over responsibility for the Colonial Products Advisory Bureau. DR. J. R. FURLONG, the present principal of the bureau, who is due to retire at the end of this year, has agreed to stay for a further year as Deputy Director.

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Market Reports

LONDON.—The demand for industrial chemicals has been maintained at a good level despite the continued slowness in the movement of supplies to the textile industry. Overseas inquiry has been on a good scale and recent export figures compare favourably with the previous year. No major price changes are reported other than for zinc oxide which are now: Red Seal £157, Green Seal £158 10s., White Seal £159 10s., Gold Seal £159 10s. and B.P. £172 per ton for 2-ton lots. The prices for bismuth compounds are expected to show a slight drop following the price reduction of refined bismuth from 25s. to 21s. per lb. The coal tar products market remains steady, showing a good call for pitch, crude tar and road tar. Creosote oil continues to find a good market both at home and overseas, but cresylic acid is quiet.

MANCHESTER.—After the holiday dullness trading in heavy chemical products on the Manchester market has been brisker during the past week, though the continued unsatisfactory conditions in the textile industries and one or two other outlets have again limited the demand for a fairly wide range of chemicals. Most other lines are in steady request both on home and overseas accounts, but uncertainty as to the future trend of prices in the non-ferrous metal compounds makes for caution in placing new business in these. Seasonally quieter conditions are ruling in the market for fertilisers, while in the tar products a steady outlet is reported.

GLASGOW.—Trading has been spasmodic throughout the past week due mainly to the uncertainty caused by the fall in prices of a large number of chemicals. Under the circumstances, the majority of manufacturers and traders report a fairly satisfactory week. Export remains fairly quiet.

Copper Plant Possible

A big American copper company may establish a plant for the treatment of uranium and copper ore at Australia's largest uranium field—Rum Jungle—following a three-day visit by Mr. Bracken, of the Kenocte Copper Company. Mr. Bracken refused to comment on his company's plans, but it is known that the firm is interested in establishing plant for the treatment of copper in Australia. Rum Jungle is only one of a number of mines which have been inspected by Mr. Bracken. While there he conferred with officials of the Commonwealth Bureau of Mineral Resources which is anxious to have the preliminary treatment of uranium ore carried out at Rum Jungle.

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These fans will ensure trouble-free working with high efficiency when used for draughting highly corrosive gases and fumes, including:—

SULPHUR DIOXIDE AND TRIOXIDE, HYDROCHLORIC ACID, CHLORINE, HYDROFLUORIC ACID, FLUORINE, NITROUS AND OTHER CORROSIVE GASES.

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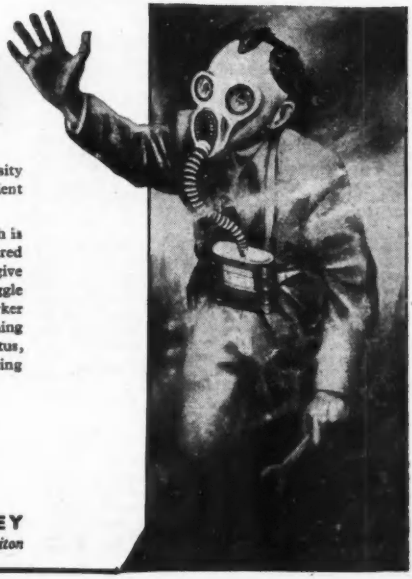

IN Chemical Works, Refrigerating Plants, etc., the necessity for dealing with gas escapes and repair work calls for efficient protection of the men on the job.

This is provided by the " PURETHA " Respirator, which is comfortable, efficient and simple. Its canisters are coloured according to the gas or group of gases against which they give protection. Full mask and mouthpiece, nose-clip and goggle types. All other protective devices for the industrial worker also manufactured and supplied : Self-contained breathing apparatus, smoke-helmets, short-distance fresh-air apparatus, resuscitating apparatus, dust masks, protective clothing goggles, etc.

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CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagemen of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS in various Government Departments. The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. A closing date for the receipt of applications earlier than December, 1952, may eventually be announced either for the competition as a whole or in one or more subjects.

The posts are divided between following main groups and subjects: (*a*) Mathematical and Physical Sciences; (*b*) Chemistry and Metallurgy; (*c*) Biological Sciences; (*d*) Engineering subjects; and (*e*) Miscellaneous (including, *e.g.*, Geology, Library and Technical Information Services).

AGE LIMITS: For Experimental Officers, at least 26, and under 31 on 31st December, 1952; for Assistant Experimental Officers at least 18 and under 28 on 31st December, 1952. Extension for regular service in H.M. Forces.

Candidates must have obtained, or be taking examinations during 1952 with a view to obtaining, the Higher School Certificate with mathematics or a science subject as a principal subject, or the General Certificate of Education in appropriate subjects, or the Higher National Certificate or other specified qualifications. Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. Candidates over 20 will generally be expected to have higher qualifications.

Inclusive London salary scales:—

Experimental Officer: £628-£786 (men); £533-£655 (women).

Assistant Experimental Officers: £275-£586 (men) £275-£489 (women).

Starting pay according to age up to 26: At 18, £275; at 26, £498 (men); £467 (women).

Somewhat lower rates in the provinces.

Further particulars and application forms from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1**, quoting No. S94-95/52. Completed application forms should be returned as soon as possible. 16327/100/JW.

THE MIDLAND TAR DISTILLERS LTD. require a **CHIEF CHEMICAL ENGINEER**, the post being vacant owing to the death of Mr. Roland Scott. Only applicants of outstanding ability and wide experience will be considered. Assistance will be given in obtaining suitable living accommodation. The salary will be £1,500 per annum or over according to the ability and qualifications of the candidate. A compulsory contributory pension scheme is in operation. All replies should be addressed to the **PERSONNEL MANAGER, THE MIDLAND TAR DISTILLERS LTD., OLDBURY.**

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CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON," TELPHONE 3285 EAST**

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CHEMICAL PLANT

"PULMAC" GRINDER by Int'l. Pulverizers. Speed, 4,000 r.p.m. Motorised 400/3/50. Vertical concentric beater type mill with 12½ in. diam. chamber and two sets fixed beaters. Vibrator feed to mill centre.

Edgar Allen "Stag" **COMBINATION TUBE MILL**, 28 ft. × 5 ft. diam., divided by cast steel diaphragms into three compartments, one 4 ft. 6 in. long with stepped steel cast liners, one 5 ft. 9 in. long, and one 16 ft. long, both with C.I. bar liners. Mill rotates at 27.7 r.p.m. in 20 in. diam. × 16 in. swivelling trunnion bearings. Driven through David Brown reduction gear. Approx. 12 tons 2½ in.-1 in. balls available. Output when grinding coal, 4½ tons per hour, 85 per cent through 170 B.S.P. seive.

"Briton" **GRINDER**, type B.11 by Christy Norris. 24 swinging hammers on rotor shaft, 2½ in. diam. Feed aperture, 12 in. × 7 in. Motorised 400/3/50.

C.I. totally enclosed Unjacketed **MIXER**, 6 ft. int. diam. × 6 ft. deep on straight, 3 ft. hemispherical bottom, domed cover. Vertical glanded 4 in. diam. agitator shaft fitted two shrouded propeller type agitators. Fast and loose pulley drive.

Unused 30-gal. Stoneware **MIXER**, by Hathernware, totally enclosed and acid- and heat-resisting. Grouted in C.I. casing on a four legs. 1 in. centre bottom outlet. Fitted two Vitreosil 4kW. immersion heaters. Motorised 400/3/50.

S.J. **VACUUM MIXER**, by Bartle. Int. dimensions, 3 ft. 6 in. × 2 ft. 6 in. × 3 ft. 3 in. Perf. paddle-type agitators fitted to 2½ in. diam. shaft. 1 in. bottom outlets at each end. Close fitting lid, bolted. Fast and loose pulley drive.

Four **SIFTER MIXERS**, by Young. M.S. Mixing Trough, 64 in. × 21 in. × 22 in. deep. Blending chamber feeds material to positive action brush sifter. Fast and loose pulley drive.

ROTARY VACUUM FILTER by Davey Paxman. Drum, 33 in. × 36 in. diam., with stepped perfs. Fast and loose pulley drive through spur and worm gear.

Two Recessed Plate-type **FILTER PRESSES** by Manlove Alliott, with 54 plates 36 in. sq. × 1 in. thick. Hand-operated closing gear.

EIGHT **FILTER PRESSES**, plate and frame type, each with 51 frames forming cakes 29 in. sq. × 2 in. Individual plate discharge. Plates have ribbed surfaces.

NEW 1/16 h.p. Variable Speed Portable Stirrers, 200/250 A.C./D.C., 50-2,000 r.p.m. Stainless steel shaft 2 ft. long with two propellers.

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1½, 2½ and 3½ size belt-driven **DISINTEGRATORS** by Christy & Norris or Harrison Carter

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Four **ROTARY BOWL MIXERS.** 5 ft. diam., cast-iron built, inclined agitators by Baker Perkins

One excellent **EVAPORATING UNIT,** comprising Copper Vessel, 4 ft. diam. by 5 ft. 6 in. deep, jacketed on the bottom, with copper swan-neck, C.I. catch-pot, vacuum pump and fittings including thermometer and gauge.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double " Z " arms, pans 31 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber. 28 in. by 29 in. by 27 in. deep, with double " U "-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6ft. by 4 ft. high to the top of the tipping screw

No. 209 One **HORIZONTAL U -SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

Two **FILTER PRESSES,** each fitted 68 wood recessed plates, 2 ft. 8 in. square, centre fed, with enclosed bottom corner delivery, cloth clips and belongings.

One **DEHNE FILTER PRESS,** cast-iron built, fitted 45 recessed ribbed plates, 2 ft. 8 in. by 2 ft. 8 in. by 1¼ in., with bottom corner feed, cloth clips and bottom corner separate outlets, angle lever closing gear, etc.

SIMON HORIZONTAL TUBULAR STEAM-HEATED DRIER, barrel with steam-heated tubes, 12 ft. long by 5 ft. diameter.

Further details and prices upon application.

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GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14.** (Tel. . East 1844.)

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1 Ebonite lined 1,000 gallon, totally enclosed m.s. cylindrical **TANK,** dished bottom, detachable top.
1 Ebonite lined 700 gallon, as above. Both as new.
2 open top 200 gallon stainless steel **TANKS,** 20's gauge
1 s.s. rectangular 600 gallon **TANK,** 16's gauge, arranged with hinged lid. In channel iron frame.
1 Mixing **CHURN** 7 ft. long by 3 ft. 6 in. diam. in mild steel. Electrically driven through totally enclosed double reduction gear.
3 stainless steel motorised **AGITATORS,** direct coupled to 5 h.p. geared motors, 2 in. stainless steel shafts, 3 bladed propellers, 180 r.p.m. As new.
2 Enamel lined **EVAPORATING** or **CRYSTALLIZING** pans by **PFAUDLER,** capacity 30 gallons, arranged with jackets for 30 lb. p.s.i. w.p.
1 single deck **VIBRATING SCREEN** by **PORTEOUS,** detachable screen at present 150 mesh.
" **MORWARD** " Trough Powder **MIXERS** " U " shaped in sizes 8 to 100 cu. ft. capacity, arranged with scroll type mixing gear.

JACKETED BOILING PANS

One 1,500 gallon (second hand), 200, 150 and 100 gallon (all new) any of the above can be arranged with mixing gear.

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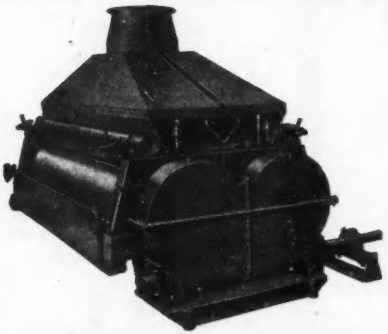

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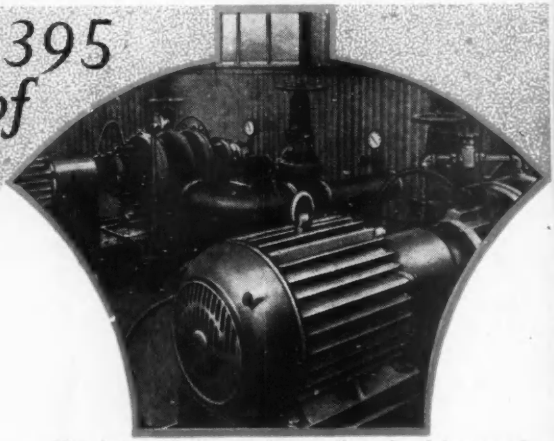

The photograph shows 15 h.p. totally-enclosed flameproof motors driving Sigmund pumps at the Shell Chemical plant where 195 M-V motors are installed; 200 more are installed in the Shell Oil refinery nearby.
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